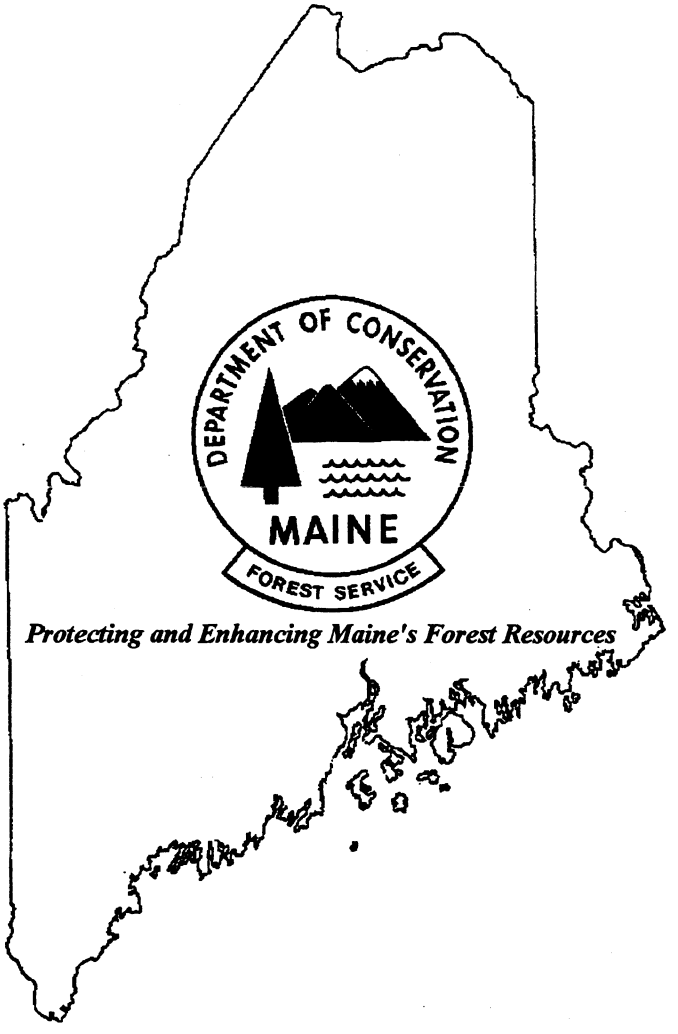
Forest & Shade Tree Insect & Disease Conditions

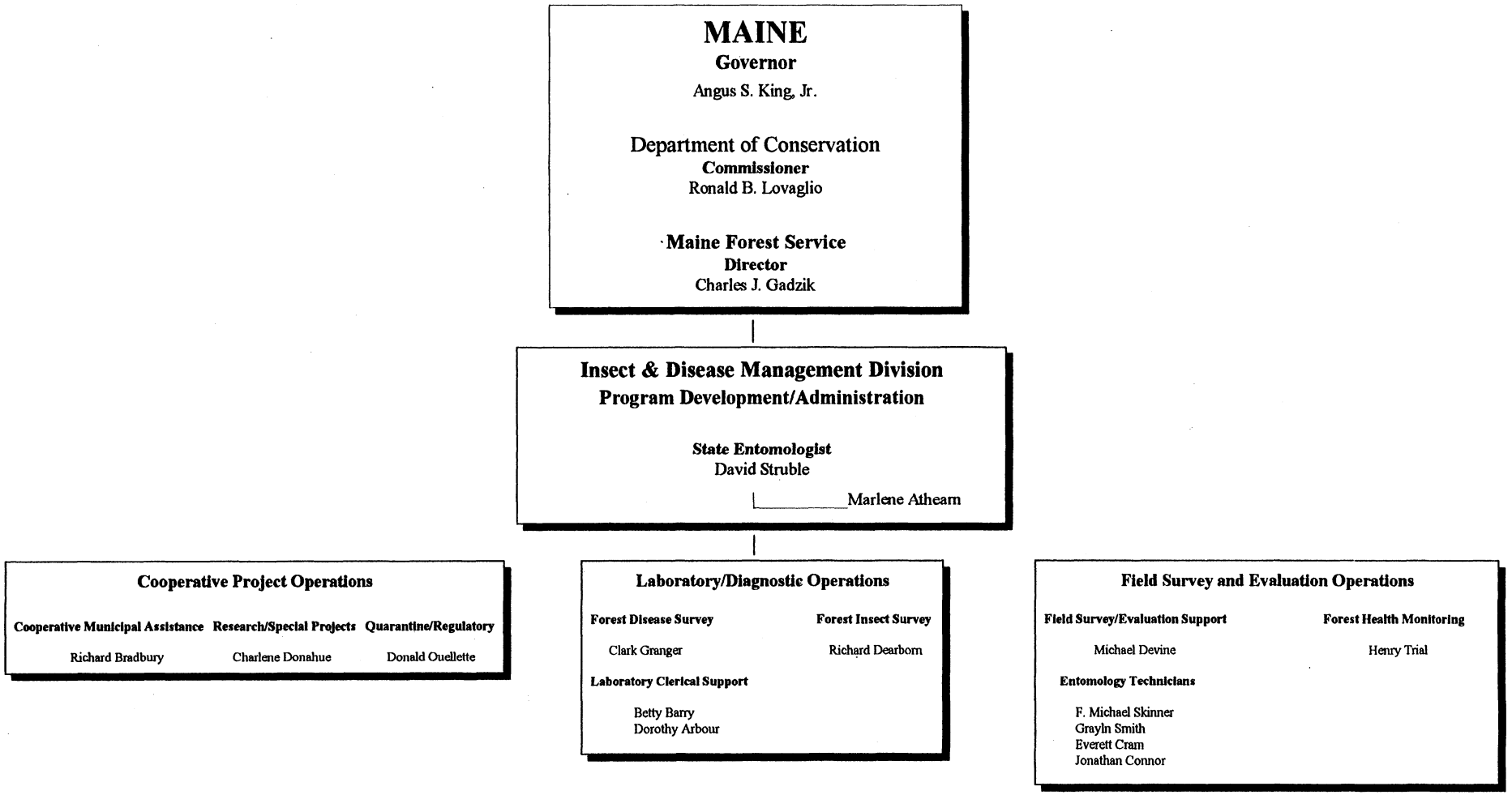
for Maine

A Summary of the 1997 Situation



Insect & Disease Management Division
Summary Report No. 12
March 1998

Maine Forest Service
MAINE DEPARTMENT OF CONSERVATION
Augusta, Maine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A special debt of gratitude again goes to **Betty Barry** who had to put all of the pieces of the puzzle together for review and then integrate the multitude of changes and corrections necessary to produce this finished product. Betty and **Dot Arbour** are keepers of the mailing list and prepare this summary for mailing.

Our thanks go to many other administrative and field staff in the Maine Department of Conservation who facilitate much of our work and to cooperators associated with the USDA-Forest Health Protection, USDA-APHIS, Maine Department of Agriculture, University of Maine at Orono, and cooperators in other New England States and Maritime Provinces of Canada. Our thanks go too to our clients who keep us apprised of what they see in the course of their work.

Suggestions for Quick Access to Particular Items

This season's report is set up in the same format used in last year's report. The Table of Contents along with the "Highlights" section and the Index should still provide most of the help you need in narrowing down your search for items of particular interest. Cross referencing within the text is used in the case of complex problems. We have again provided our very brief **one-point assessment table** (Table 1, p. 11) for damage level trends for quick review for many of our common problems. You should still scan the entire report to pick up **new items** of interest as well. Keep in mind the following when scanning for particular problems:

- **Insect problems** associated with both trees and shrubs in forest, plantation, shade tree and ornamental situations are broken down into only two categories. All **softwood (conifer) insect pests** are grouped in Section A (p. 15). All **hardwood insect pests** are in Section B (p. 25). Three additions of special note this year are; a map of **Biophysical Regions** (p. 14), a section on **phenology** (p. 14) and a table showing **gypsy moth defoliation** in Maine by year from 1924 to date (p. 31).
- **Miscellaneous insects and other arthropods of medical, nuisance or curiosity significance** have their own section (p. 36) which also includes an expanded series of tables showing the variety of **public assistance** requests received by I&DM (p. 39).
- **Tree diseases and injuries** are listed alphabetically in a separate section beginning on page 42.

FOREST & SHADE TREE INSECT & DISEASE CONDITIONS FOR MAINE
A SUMMARY OF THE 1997 SITUATION

Comments from the State Entomologist

In looking back over the Comments of the past few years, the recurrent theme was that resources continued to shrink, but that by being innovative and working collaboratively with our various client/cooperators we were continuing to address the issues of the day and provide the service to the people of the state as charged in our legislative mandate. It gives me great pleasure to be able to report that in 1997 our resources - both staffing and financial - remained stable. At the same time, our efforts to expand our capabilities through partnerships continued to bear fruit.

For some cases in point:

- We maintained a viable browntail moth control project by providing technical assistance to affected home owners and communities; populations were successfully suppressed using an aerial application of Dimilin 4L on approximately 600 acres of residential lands in three coastal municipalities. Several hundred individual lots were also treated with Tempo or Dimilin applied with hydraulic equipment. In addition, collaborative efforts with the USFS and other cooperators have produced a formulation of Bt effective against browntail moth. We also are pursuing registration of an alternative IGR pesticide which is reputed to pose less risk to the marine environment than the currently used dimilin. The development of these tools greatly improves our options for dealing with BTM.

- Our IDM staff have worked with several major landowners to address an increasing infestation of yellowheaded spruce sawfly on plantation spruce and 1,123 acres were successfully treated without incident.

- We are working with other branches of the MFS and with various private groups and local governments to address the ongoing decline of Maine's coastal spruce resource. While we cannot undo 50 years of past practices, we are developing options for dealing with the situations that now exist and which avoid recreation of the situations which have proven so vulnerable to catastrophic impacts from pests like spruce beetle, dwarf mistletoe, and hemlock looper.

- With the USFS and our counterparts in the other New England states, we have been investigating the potential spread and associated impacts of hemlock woolly adelgid (HWA). Recent work by researchers at the University of Vermont has shown that at temperatures around -22°F up to 95% of the overwintering adelgids died. While these results do not indicate that HWA is precluded from expanding its range into Maine, they do suggest that the problem may be greatest in southern and coastal sections, and that the levels of impact on our hemlock resources may be less severe that has been seen to our south.

- IDM, the Stream Monitoring project at DEP, and the Dept. of Applied Ecology at the University of Maine (Orono) were awarded a $49,298 grant for a joint proposal to the Maine Outdoor Heritage Fund to improve access to existing entomological databases in Maine public institutions. Although this may sound a bit esoteric, we are receiving an increasing number of requests (generated by ecosystem stability/resiliency and biodiversity questions) for information from our historical records. This grant will enable us to develop the tools to more easily provide this information.

In a related success story I can report that our ability to inform the public regarding pest conditions and suggested remedial options continues to increase. Our IDM web page, which was established in May, had over 1200 hits in 1997 and got commendations for content and utility. While we continue to use the general media and more targeted presentations to professional and commodity groups to provide the initial information outreach to our customers, the number of specific requests for assistance that we received and processed in 1997 was up by more than 10% from the previous year.

With a successful year behind us, the obvious question is, "where do we go from here?" My initial response is that we will continue our current course. This is the approach that has allowed us to meet the needs of our clients. We continue to be concerned about the potential impacts from exotic pests. In particular, last year we spoke of the potential threat from the Asian longhorned beetle. To date, none have been found outside their current beachhead in New York. Nonetheless we remain vigilant. We are working with our partners to develop improved descriptive brochures for public use. These should be available by late spring- before the adults would emerge.

Regarding new activities: I believe that the largest forest health issue in Maine at this time is the public perception that current forest management practices are not sustainable, and that change of some sort is necessary to assure environmental and economic stability for the long haul. This situation has been well demonstrated by the controversy surrounding the various forestry referenda. In the wake of this process, where all sides claimed victory, the Legislature is grappling with the various spin-off bills. At this writing, the outcome is not clear, but the one point that all sides seem to agree on is that we need more timely, unbiased, and relevant information upon which to make decisions.

Concurrently, the USFS has been charged by Congress to investigate alternatives to the periodic forest inventories which are conducted by the Forest Inventory and Analysis (FIA) Unit of the USFS. The National Forest Health Monitoring Program (NFHM in which Maine is a charter member state) has been held up as a model for the new FIA. Where IDM has been the MFS liaison to the NFHM program (and was also heavily involved in supporting the recent FIA resurvey of Maine's forest resources), it is most likely that we will be major players in any new Forest Inventory & Monitoring effort.

Similarly addressing forest management impacts, in 1998 we will be cooperating with the Shifting Mosaic Project on a new initiative to assess the potential of terrestrial insects and spiders as indicators of certain critical ecological processes across a range of management regimes.

This past January's (1998) ice storms heavily damaged forest and shade trees in a band across southern Maine. Homeowners and forest landowners need to be able to put their situation in proper context, to know what their options are, and have the tools to address the situation. With the other branches of the MFS, we will be heavily involved in assessing the situation and developing prescriptive tools.

These Forest & Shade Tree Insect & Disease Condition Reports serve as one of the primary vehicles for relaying general information from us to you; it is critical that they be useful. We sincerely hope that you will read them, use them, and keep in touch with us regarding information or suggested improvements so that they continue to meet your needs.

As always, I repeat that this annual summary is not an exhaustive summary of Division activities and accomplishments. Although we try to acknowledge you, our client/cooperators, the few words written here do not begin to convey the extent of our reliance or express our appreciation for your contribution. Without you we would not be able to effectively gather information regarding pest and forest conditions; nor could we as effectively disperse it out to the larger public.

Cooperative MFS/USFS Projects

Competitive Focus Funding Grants

A Reevaluation of Forest Regeneration in Spruce Budworm Damaged Stands Within Baxter State Park

The I&DM Division continued an evaluation of forest regeneration of spruce budworm killed stands in Baxter State Park. The unaltered progression of the decline and recovery of budworm damaged stands in Baxter State Park has provided a unique setting for study of this natural system. During the 70's and 80's a severe outbreak of spruce budworm that covered most of Maine's spruce/fir forest type caused extensive mortality to fir and spruce in Baxter State Park. Because of the "forever wild" mandate on most of the Park lands, budworm induced mortality progressed unchecked in all but the scientific forestry section of the Park. Portions of the Park experienced fir mortality exceeding 95% and spruce mortality that ranged from 10 to 60%. These stands are now regenerating naturally and are providing an opportunity to further assess impacts of budworm and regeneration composition in stands not subject to conventional land management practices.

The potential of this unique study area was realized early in the outbreak and stand evaluation plots were established by the US Forest Service (USFS) and the University of Maine, initially to assess expected stand decline. Stand composition and condition data was collected annually by the USFS from 1977 through 1986. In 1989 I&DM staff made for the final measurement of surviving overstory trees and provided these data to the USFS, thus completing the study of the decline phase of the cycle. Beginning in 1989, I&DM established regeneration plots on a subset of the original plot network. The goal of this regeneration phase of the Baxter study was to document stand regeneration following unchecked damage by spruce budworm. Regeneration compositions will be compared to original stand composition as measured in the initial 1977 assessment to detect any species shifts. The overall health of regeneration and surviving overstory in assessment plots will be evaluated using National Forest Health Monitoring project variables. Overstory survival will be compared to the 1989 data set to determine any additional losses since the last assessment.

Partial funding for this project was provide in a grant by the US Forest Service in 1995. Most of the data required for this project was collected on schedule in the summer of 1996, however due to other commitments, crown condition ratings for one assessment block had to be delayed until the summer of 1997. These data were gathered in July of 1997 and the dataset is now complete. Project analysis and reporting is now underway. A final report is anticipated during 1998.

Maine Forest Service Insect and Disease Historical Database - The current need to identify and catalog various natural resources within Maine as critical components of biodiversity and forest health studies prompted the MFS to develop electronic storage, manipulation and query capability for existing historical datasets. The IDM division has worked cooperatively with the USFS and UMO to develop this capability for the historical Forest Insect and Disease Survey (FIDS) information.

Work-study students, under the direction of Dr. Kathleen Murray, have entered information from over 10,000 forest insect and disease survey slips during the past year. Many of the slips had multiple insect and/or disease diagnoses on them which translates into over 27,000 insect and disease records. The database now contains over 37,000 insect and disease records from 1970 to 1995.

Information from the Historical Database was tested for use in generating GIS maps, in analyzing trends and in looking at spatial and temporal relationships. The data was easily exported into applications designed to handle these tasks and it performed well. A report on these procedures is expected in 1998.

The data from the Maine Historical Database which was originally in the Approach® format has now been moved into Access®. A Maine Forest Service programmer is currently working on maintaining the same file structure and links in Access® as were designed in Approach® so that the data files can be accessed using either program. This will allow Maine to continue entering data using the same Approach® format that we have

successfully used over the past year and a half. At the same time if we wish to share information with others we would be able to do so. Once the basic structure is defined in Access® then designing basic screens for data entry should proceed rapidly. This will allow the program to be used by others to handle their data in a similar fashion to the MFS.

Phenology and Damage Relationships with Yellowheaded Spruce Sawfly (Pikonema alaskensis) in Black Spruce Plantations in Maine - The yellowheaded spruce sawfly periodically causes significant mortality and growth loss across the North American boreal forest regions. It is currently at epidemic levels in portions of Maine and causing significant growth loss and mortality in young black spruce plantations in Western Maine. The Maine Forest Service is working with landowners and managers to help them plan sawfly management activities. Unfortunately, there are critical gaps in our understanding of this pest and its relationships to its hosts. Most yellowheaded spruce sawfly research has been performed on white spruce, its reported preferred host. However, the present outbreaks in Maine, Quebec and New Brunswick are primarily on black spruce. The relationships between this pest and black spruce are poorly understood. The degree of synchrony between host and insect may be critical to timing pest management activities and may play a key role in determining host preference and host susceptibility to attack and defoliation. Host phenologies differ among the species and is also affected by previous defoliation. That is, trees that have been heavily defoliated during the previous season may be less susceptible to sawfly attack due to damage-related delays in the timing of budbreak. In order to develop economically viable and effective management programs we need to define action thresholds for the yellowheaded spruce sawfly on young black spruce. The results from this study will provide information which will be useful to forest managers, landowners, and researchers across the boreal forest zones in the US and Canada. This project represented a joint effort by the Maine Forest Service and the University of Maine. It was conducted on property owned by S. D. Warren and Mead Paper and was funded by the US Forest Service.

The objectives of this project are to:

1) To determine the relationship between black spruce and white spruce and yellowheaded spruce sawfly (YHSS) development.
2) To determine the relationship between YHSS population levels and damage to spruce trees.

Plantations in western Maine were surveyed during the fall and winter of 1996 for yellowheaded spruce sawfly damage. Three black spruce plantations and three white spruce plantations were selected for measuring spruce and sawfly phenology.

The first yellowheaded spruce sawfly adults were found on May 29, 1997 with peak capture occurring on June 23. Eggs were found in new shoots beginning June 13th with peak counts occurring on June 23. Mean shoot index was four for black spruce (needles were beginning to separate but shoots not yet elongating) at the time of peak egg laying. First instar larvae were observed on June 23. Peak second instar occurred on July 1st, peak third instar on July 8th and peak fourth instar on July 14. Only fifth instar larvae were found on subsequent checks.

Spruce tree damage was based on whole tree estimation of percent defoliation and ranged from zero to almost 100% on individual trees. Larval counts per branch sampled ranged from 0 to 23.

Analysis of the data is underway and the final report will be published in 1998.

National Forest Health Monitoring Program (NFHM)

Annual measurement of the National Forest Health Monitoring detection monitoring grid continued on a subset of 42 of the state's 137 total plots in 1997. Plots measured were selected by the same formula developed and used in 1996. This sampling scheme includes a rotating one quater of the detection monitoring grid plus an additional twelfth of the plot network that is measured for two years in succession. After a severe funding shortage nearly led to the cancellation of 1996 field work in New England, the program was stabilized around this new sampling scheme that called for annual measurement of approximately a third of the plot network. In 1997, forty

of the measured plots were forested and two non-forested. Two crews of two technicians were employed from late May to September to complete the 1997 assessment.

In addition to the standard measurement type 3 assessment (complete evaluation of all variables) on all measured plots in 1997, funds were provided to field test a new method of soil sampling on the NFHM grid in other states in the northern area. A modified lichen evaluation was used on plots in the western US. Evaluation of soils and lichens may be added to the measurement suite in Maine in 1998.

NFHM methodology has developed into a valuable assessment tool for I&DM and its counterparts in other jurisdictions. Not only has uniform, quality controlled NFHM data provided excellent baseline information for comparisons that transcend state jurisdictions, variables and the sample footprint developed in the NFHM program have proven valuable for assessment of specific pests and abiotic stressors. Detection monitoring plot data from the normal NFHM grid has been compared annually to data from "special" beech and birch plots established using the NFHM footprint. NFHM protocols have been used in Maine to assess brown ash and general hardwood declines. NFHM crown condition variables were also used to assess aspects of a hemlock looper outbreak that included much of New England in the early 90's. Because other New England cooperators were already familiar with measurement techniques, little additional training was needed to implement or interpret results from this region wide effort.

An evaluation of insect and disease conditions was conducted by the assessment crew at each NFHM plot sites in 1997 as has been the practice in recent years. These pest assessments include a checklist of common insects and diseases often seen in the forest type specified for each NFHM plot. NFHM crew personnel employed in 1997 are trained in pest identification and most have considerable I&DM experience. Their insect and disease observations were a valuable supplement to ongoing survey and evaluation efforts of the Division.

North American Sugar Maple Project (NAMP)

NAMP was formed in 1987 as a joint project between Canada and United States to address public concerns over the health of sugar maples in North America. From 1987 to 1997 the program annually collected data on tree mortality, crown dieback, and crown transparency (a measure of light passing through the leaves of a tree crown) from 233 plots distributed over ten states and four provinces. As established, the eighteen plots in the western portion of Maine were apportioned equally between natural stands and managed sugarbushes. The specific objectives of this project were as follows:

- Determine the rate of change in sugar maple condition ratings.
- Determine if the rate of change in sugar maple condition ratings was different among:
    a. various levels of sulfate and nitrate wet deposition.
    b. sugarbush and non-sugarbush forests.
    c. various levels of initial stand decline conditions.
- Determine possible causes of sugar maple decline and the geographical relationships between potential causes and extent of decline.

Regarding these objectives: the NAMP dataset captured the annual fluctuations in crown condition (which have been analyzed and reported upon) and addressed the analytical questions. In summary:

- NAMP found no widespread pattern of decline caused by pollution stress, however, trees growing in areas with higher levels of acid deposition *tended* to have thinner foliage than those growing in areas with lower acid deposition. The association between acid deposition, soil buffering capacity, and tree health requires further work.
- NAMP found that tree health was similar between sugarbushes and untapped maple stands.
- NAMP found that trees with less than 30% dieback had a 90-99% chance of survival and a better than 80% chance of improving condition. Trees with between 40-50% dieback had only an even chance of

recovering, and those with more than 60% crown dieback had less than 30% chance of surviving and improving.

- Cases of tree decline were found to be highly correlated with bole and root injury. While insect defoliation and drought incidents seen during this period caused trees to have significantly thinner crowns, unless stresses were contemporaneous most trees recovered in 1-2 years.

With the achievement of the original objectives, there is reluctance on the part of the USFS to subsidize collection of additional data. However, beyond meeting the original objectives, the NAMP dataset has also provided tantalizing indications of answers to other tree health questions (e.g.: relationship between crown transparency and resiliency/resistance to stress events). In addition, the dataset is also a benchmark against which to evaluate subsequent stress events.

The MFS is investigating various possibilities for continuing further sugar maple evaluation. If USFS funding is terminated, we have laid the foundation for a cooperative venture with neighboring states and the Canadian Forest Service. Although this approach would not subsidize data collection, it would provide a mechanism to mesh and analyze local data with that from adjacent states and Canadian provinces. The situation as of 1996 is summarized in the 1997 foldout leaflet by Cook, Allen, Pendrel and Molloy (see Publications p. 9). A similar publication for 1997 is in process. We currently plan to collect plot data again in 1998.

Neem Applied for Management of the Yellowheaded Spruce Sawfly: Effects on Non-target Arthropods (NAPIAP)

The yellowheaded spruce sawfly (YHSS) is currently at epidemic levels in portions of Maine, causing significant growth loss and mortality in young spruce plantations. This study was undertaken to compare neem formulations with a conventional insecticide in efficacy against YHSS and the effects on non-target arthropods. This project represents a joint effort by the Maine Forest Service and the University of Maine and is funded by the USFS under the National Agricultural Pesticide Impact Assessment Program (NAPIAP).

Field Trials. Treatments were applied on July 7-8, 1997 using a UH 1B helicopter. The two neem products used were Neemix 4.5 EC (Thermotrilogy Corp.) applied at 37 g ai/ha to a 3.6-ha block and at 18.5 g ai/ha to a 2-ha block, and Fortune Aza 3.0 EC (Fortune Biotech Inc.) applied at 37 g ai/ha to a 3.6 ha block. The sticker Bond (Loveland Industries Inc.) was added at 2% and an antievaporant Intac (Loveland Industries, Inc.), was added at 1.6% to both neem formulations. The conventional insecticide, Sevin XLR Plus (Rhone-Poulenc Ag Co.) was applied at 0.38 liters/ha to three blocks. Application of neem was later then had been targeted which resulted in the average stage of YHSS larval development being at peak of the third instar rather then peak of the second instar.

Both Neemix-treated blocks received adequate spray coverage (ca. 2-4 droplets/cm^2), but average deposit in the Fortune Aza block was less than 1droplet/cm^2. Droplet size was largest in the Fortune block also, indicating poor deposit of fine droplets. Poor spray deposit in the Fortune block may have been due to less than optimal weather conditions as this block was sprayed later in the morning than the Neemix blocks.

The effects of the treatments on YHSS larval population densities were determined by comparison of pre-spray and post-spray branch counts of larvae in treated blocks with those in untreated blocks. Sampling sites were established to measure effects on non-target species. Plexiglas aerial interception traps, pitfall traps and malaise traps were placed in each block and sampled before and after treatments.

Estimates of treatment-related population density changes were somewhat complicated by the fact that larval counts after treatment were lower than prespray counts in the untreated control blocks. Declines in the control blocks at 7 days post-treatment were most likely the result of within-tree movement of larvae away from the sampled mid-crown branch to lower-crown branches as the mid- and upper-crown became defoliated. At 14 days post-treatment, further declines in lower-crown branch counts were probably the result of movement of larvae off

from the trees as the late instars dropped to the ground to spin cocoons. Natural mortality may also have contributed to the apparent YHSS population reduction in control blocks.

Population reduction in the treated blocks was adjusted for the decline in the untreated blocks. Estimated larval mortality, calculated by comparison of counts of larvae per branch before and after treatment in treated and untreated blocks, indicate that Neemix was about 60% and 36% as effective, at the higher and lower concentrations respectively, as the conventional insecticide. The second neem product, Fortune Aza, provided no YHSS control, though the poor spray deposit achieved in that block was undoubtedly a factor.

Counts of dead larvae collected in drop cloths placed under sample trees in each block also provided an estimate of treatment-caused YHSS mortality. These data indicate that mortality, though lower in the Neemix blocks, occurred over a longer time period when compared with the Sevin blocks. The cumulative total number of dead larvae collected in drop cloths was roughly the same in the Neemix full rate treatment compared with the average collected in the Sevin-treated blocks. There were about half as many dead larvae collected in the half-rate Neemix treatment compared with the full-rate Neemix treatment, while the number of dead larvae collected from the Fortune block was very low.

Foliage protection in each of the neem treatments was less than that provided by the conventional insecticide. However, it should be noted that prespray YHSS densities were highest in the neem-treated blocks (57-167% higher than control blocks and Sevin blocks).

Laboratory Assay. Fourth and fifth instar YHSS larvae were collected from 10-50 trees at each of several different field sites for a laboratory assay. Neem formulations were diluted to 1 x 10^{-3} g ai/ml, 10^{-4} g ai/ml, 10^{-5} g ai/ml, 10^{-6} g ai/ml and 10^{-7} g ai/ml in distilled water. Water alone was used for the control. Larvae were allowed to feed on the treated foliage in petri dishes for 4 days, then on fresh untreated foliage for 3 more days. The number of live and dead larvae in each dish were counted at 7 days after the start of the assay.

Neemix was slightly more effective than Fortune Aza against YHSS, however the difference is not likely to be significant given the small number of insects used in this test. Only the highest concentration of Neemix, which was almost twice as high as the highest concentration applied in the field, yielded 100% mortality. The highest level of mortality obtained with Fortune Aza was 75%. Because the amount of material that actually reaches the insects in an aerial application is expected to be considerably less than in a laboratory assay, it appears that the concentrations used in the field were probably not high enough to provide adequate control of YHSS in later stages of larval development.

Effects on Non-target Arthropods. We are in the process of sorting, identifying, pinning, and identifying the arthropods collected from pitfall, interception, and malaise traps, as well as those extracted from soil samples. Results are not yet available.

Summary - Earlier tests conducted in Canada showed good population reduction and foliage protection with a neem product applied at 25 g ai/ha with fixed-wing aircraft against peak second instar YHSS. One possible explanation for the difference between the Canadian study and ours is the more advanced stage of larval development we had at the time of treatment. Larval development was peak third instar in most blocks in our field test. In the laboratory test against fourth and fifth instars only 69% of the larvae were killed at concentrations roughly equivalent to those applied in our field test. Weather, application equipment, neem formulations, landscape, or YHSS population densities undoubtedly influence field test results and may also have contributed to the differences between our findings and the earlier Canadian tests.

A full report of the results of these trials will be available at a later date.

Maine Outdoor Heritage Fund Grant - Computerization of Insect Collections

Computerization of Holdings in the Maine Forest Service, the University of Maine and the Department of Environmental Protection Insect Collections

There are three major publicly owned collections in Maine: the University of Maine collection in Merrill Hall at the University in Orono; the Maine Forest Service collection in the I&DM lab in Augusta; and the Stream Biomonitoring Reference Collection at the Division of Environmental Assessment, Maine Department of Environmental Protection, Augusta.

Information from the labels on or with each specimen will be recorded in a relational electronic database and bar codes will be placed in the collection to associate specimens with the recorded information. The location information for town or county (where available) will be entered in a format that can be used in Geographic Information Systems (GIS) mapping. The process is labor intensive because pinned specimens are very fragile, some are irreplaceable and most will need to be handled to read labels.

The primary product of this project will be electronically accessible, specimen-based databases of the three major insect collections in Maine. These databases will be available to local users, such as resource managers, governmental agencies in Maine and conservation biologists, through access to the University of Maine Entomological Museum computer facilities and users in general via the World Wide Web (WWW) on the Internet.

Computerizing this insect information will allow documentation of the existence, location or habitat of the majority of invertebrate species found within the state of Maine. Users will be able to build map layers in GIS systems to link the invertebrates to other information such as forest type and management practices. The potential for building predictive models for future outbreaks of insects, such as spruce budworm, could be explored.

Publications

A file of publications is maintained by the I&DM Division (MFS) on a variety of subjects relating to the protection of Maine's forest resources. This file contains publications of our own plus many from other sources as well. We annually upgrade or prepare new fact sheets on a wide variety of the more common tree pest problems. While Bulletin #25 - Field Book of Destructive Forest Insects (1980) is now out of print copies of our other popular Bulletin #10 (5th Revision) - The Planting and Care of Shade Trees (1985) are still available. Our Technical Report series, now numbering 37, are listed on page 59 and many are still available. Extended conditions summary reports, such as this one, have been issued annually since 1987 (for the 1986 season). A limited number of sets of these summaries are still available.

In addition to published reports our staff continues to give talks to a variety of groups including schools and to provide items of interest to the news media and various association newsletters as well.

- The following items were published over the past year by I&DM staff:

Granger, C.A. and Geneva Duncan. 1997 (May). Integrated Crop Management Schedule for the Production of Christmas Trees. MFS, I&DM Div. Circular No. 11 (Revised). A pocket fold-out.

Insect & Disease Management Division. 1997 (March). Forest & Shade Tree-Insect & Disease Conditions for Maine - A Summary of the 1996 Situation. MFS, I&DM Division. Summary Report No. 11. 60 pp. Compiled and edited by R.G. Dearborn and C.A. Granger.

____ 1997. Forest & Shade Tree-Insect & Disease Conditions for Maine. 8 seasonal issues from April 7 through October 8. MFS, I&DM Div. Compiled and edited by R.G. Dearborn and C.A. Granger.

Ouellette, D.E. (Compiler). 1997 (April). Regulations and Guidelines for Shipping Christmas Trees, Wreaths and Decorative Plant Materials - Twigs, Nuts & Fruits Used in Wreath Making. A public information guide from the Plant Industry Div. of the Me. Dept. of Agr. and the MFS, I&DM Division. A pocket fold-out.

- Our I&DM staff cooperated with other agencies to produce the following items:

Allen, D.C. and A.W. Molloy. 1997 (February). Temporal Change in Sugar Maple Crown Condition in Maine from 1988-1996. North American Maple Project (Maine Section). Syracuse, NY. State Univ. of N.Y. CESF Draft Report. 52 pp.

Childs, R.D., E.A. Weeks and J. Nobel (Eds.) 1997 (March). The 1997 New England Management Recommendations for Insects, Diseases and Weeds of Shade Trees and Woody Ornamentals. A publication from the Univ. of Mass. Extension Urban Forestry and Landscape and Nursery Programs. 159 pp.

Cook, R.R., D.C. Allen, B. Pendrel and A.W. Molloy. 1997 (March). Condition of Sugar Maple 1996. USDA/FS and Canadian F.S. Foldout Leaflet NA-TP-05-97.

Stolte, K.W. 1997 (October). 1996 National Technical Report on Forest Health. USDA/FS Admin. Rep. FS-605. 47 pp.

- New related items of importance to forest resource managers in the Northeast:

Adams, K.B., D.C. Allen, P.D. Manion and L.P. Abrahamson. 1996. The Stewardship of Northern Hardwoods: A Forest Owner's Handbook. SUNY Research Foundation. Syracuse, NY. 84 pp.

Stoyenoff, J., J. Witter and B. Leutscher. 1997. Is the Forest Healthy? - New England & New York Region. Univ. of Mich. School of Natural Resources & Environment in cooperation with USDA/FS and State Forestry Agencies. Color Brochure. 12 pp.

Wagner, D.L., V. Giles, R.C. Reardon, and M.L. McManus. 1997 (November). Caterpillars of Eastern Forests. USDA/FS. FHTET-96-34. 113 pp.

Forest and Shade Tree Insect and Disease Conditions for Maine

1997 at a Glance

The 1997 season held few surprises although in the final analysis some noticeable changes were set in motion. Weatherwise the season started out on the cool damp side but dried out considerably, turning hot in June with cool nights. Moisture levels remained low throughout the season and failed to catch up to normal levels over most of the state in spite of scattered local "downpours." The dry conditions may have exacerbated the impact of the 1995 drought, especially on eastern white pine, and hay production fell to critical levels.

Softwood problems seemed to dominate in 1997, from spruce beetle, yellowheaded spruce sawfly and dwarf mistletoe on spruce to white pine sawfly and drought damage on white pine. Although not as serious from a forest standpoint, the browntail moth made its presence an uncomfortable experience for residents of the Casco Bay area, and a variety of other insects and diseases provided some local challenges. Arborvitae leafminer, balsam gall midge, balsam twig aphid, birch leafminer, fall webworm, mountain ash sawfly, pear thrips, white pine weevil and ash leaf and twig rust remained noticeable or increased slightly. Aspen defoliators, Bruce spanworm, fall cankerworm and larch casebearer continued to drop in intensity. Some others such as gypsy moth, hemlock looper, satin moth, spruce budworm and variable oakleaf caterpillar again remained relatively inconspicuous. Table 1 presents highlights of many of our common pests which are discussed in more depth within this report.

Those exotic pests in the news; the Asian longhorned beetle (ALHB), Asian gypsy moth, common pine shoot beetle and hemlock woolly adelgid have not yet been found in Maine.

Table 1. Damage level trends for 1997 (Compared to 1996 levels)

Those of special significance

Ash Anthracnose	↘	low
Aspen Defoliation	↓	local
Balsam Fir Sawfly	→	low endemic
Balsam Shootboring Sawfly	→	spotty and light
Balsam Twig Aphid	↗	plantations
Beech Defoliation	↘	local N, C & E
Bronze Birch Borer	→	local
Brown Ash Decline	↘	trees improving
Browntail Moth	→	2,150 A. spreading NE
Bruce Spanworm	↘	<1,000 A. central
Bud Abortion (balsam fir)	→	low
Butternut Canker	→	15 counties
Cone Buds (balsam fir)	↗	cone year coming
Dogwood Anthracnose	→	York County
Drought	↑	residual 1995 impact
European Larch Canker	→	static
Fall Cankerworm	↘	spotty, Aroo Cty. boxelder
Gypsy Moth	↘	low/endemic
Hardwood Decline	↘	improving
Hemlock Looper	→	low/endemic
Larch Sawfly	↓	locally high, <710 A.
Late Spring Frost	→	low
Maple Leafcutter	↗	local, <200 A.
Oystershell Scale	→	Spotty
Pinewood Nematode	→	local
Rd. Salt Spray/Pooling Damage	↓	low
Satin Moth	→	scattered light
Spruce Beetle	↑	high central coast, 3,110 A.
Variable Oakleaf Caterpillar	→	low/endemic
White Pine Drought Damage	↑	highs-S-1995 drought related
Winter Browning	→	low
Yellowheaded Spruce Sawfly	↑	high locally, 3,500 A.

Perennial Problems

Air Pollution	→	low
Alder Flea Beetle	→	locally high
Annosus Root Rot	→	moderate
Arborvitae Leafminer	→	locally high
Ash Leaf and Twig Rust	→	high locally
Balsam Gall Midge	↑	high
Balsam Woolly Adelgid	→	locally high, coastal
Beech Bark Disease	→	high
Birch Casebearer	↘	scattered roadside
Birch Leafminer (*Messa*)	↗	moderate, scattered
Boxelder Canker	↑	severe
Coral Spot Nectria Canker	→	low
Cristulariella Leaf Spot	→	very low or absent
Dutch Elm Disease	→	high
Eastern Larch Beetle	→	local
Eastern Tent Caterpillar	↓	collapsed
Fall Webworm	→	high locally
Fir-fern Rust	↘	low
Forest Tent Caterpillar	→	low
Horse Chestnut Leaf Blotch	→	moderate
Introduced Pine Sawfly	↑	high pops., light damage
Jack Pine Sawfly	→	moderate E coastal
Larch Casebearer	↘	spotty
Large Aspen Tortrix.	→	low and local
Meadow Vole Damage	→	local
Mountain Ash Sawfly	→	high, local
Oak Leaftier/Skeletonizer	↗	locally high S.
Pear Thrips	↗	low
Pine Leaf Adelgid	?	galls
Pine Needle Rust	→	low
Pine Spittlebug	→	local
Pitch Mass Borer	→	local
Porcupine Damage	→	locally high
Rhabdocline Needle Cast	→	moderate to high
Saddled Prominent	→	low/endemic
Saratoga Spittlebug	→	low
Scleroderris Canker	→	low
Sirococcus Shoot Blight (Larch)	↘	low
Spider Mites	→	high, local
Spruce Budmoth	→	low and local
Spruce Budworm	→	low/endemic
Stillwell's Syndrome	→	low and local
White Pine Blister Rust	→	low
White Pine Weevil	→	high

* damage levels: ↗- up slightly; ↘- down slightly; ↑- up sharply; ↓- down sharply; →- stable at level indicated.

Light Trap Survey

The 1997 season was the 55th year of this ongoing seasonal light trap survey for monitoring and detection of lepidopterous forest defoliators in Maine. A total of 26 Rothamstead (incandescent) and Green River (black light) type light traps were operated at established sites throughout the state. Twenty four of the traps were run by contracted operators in the same towns as in 1996. The other two trap sites were new and the traps were run by cooperators -Acadia National Park in Bar Harbor, and a land manager in Ste. Pamphile. The only other change involved the Topsfield trap which was moved a few miles to the yard of a new operator and, due to scheduling difficulty, could only be run intermittently. Trap type and trapping periods for all sites are summarized in Table 2. Light trap locations are depicted in Fig. 1.

Table 2. Location, trap type, and period of operation of light traps in the 1997 light trap survey

Location	Trap Type	Operation Dates	Location	Trap Type	Operation Dates
Allagash	Rothamstead	July 1-July 30 (30 nights)	Haynesville	Rothamstead	June 17-July 31 (45 nights)
Arundel	black light	June 1-July 30 (60 nights)	Kingfield	Rothamstead	July 1 -July 30 (30 nights)
Ashland	Rothamstead	July 1-July 30 (30 nights)	Millinocket	Rothamstead	June 17- July 31 (45 nights)
Bar Harbor*	black light	Intermittent Juyl 10- Aug 10	Mt. Vernon	black light	May 18-July 31 (75 nights)
Blue Hill	Rothamstead	June 17-July 31 (45 nights)	No. Bridgton	Rothamstead	May 18-July 31 (75 nights)
Brunswick	Rothamstead	June 17-July 31 (45 nights)	Rangeley	Rothamstead	June 17-July 31 (45 nights)
Calais	black light	June 17-July 31 (45 nights)	Shin Pond	Rothamstead	July 1-July 30 (30 nights)
Chesuncook	black light	June 17-July 31 (45 nights)	So. Berwick	Rothamstead	May 18-July 31 (75 nights)
Dennistown	Rothamstead	July 2-July 31 (30 nights)	Ste. Aurelie	Rothamstead	July 1- July 30 (30 nights)
Elliotsville	Rothamstead	June 17-July 31 (45 nights)	Ste.Pamphile*	Rothamstead	June 30-Aug. 8 (40 nights)
Exeter	Rothamstead	June 17-July 31 (45 nights)	Steuben	black light	June 17-July 31 (45 nights)
Greenbush	Rothamstead	June 17-July 31 (45 nights)	Topsfield**	Rothamstead	June 24-July 31 (21 nights)
Guerette	Rothamstead	July 1-July 30 (30 nights)	Washington	Rothamstead	May 18-July 31 (75 nights)

* Intermittent cooperator operation ** Intermittent operation due to scheduling difficulty

The trapping periods target potential forest pests for each specific site and forest type. Traps used to monitor spruce-fir insects were operated for thirty (30) days from July 1 to July 30; traps monitoring hardwood or hardwood-softwood insect pests were operated forty five (45) days from June 17 to July 31; traps monitoring the spring-flying hemlock looper, *Lambdina athasaria,* and other early hardwood or hardwood-softwood insect pests were operated seventy five (75) days from May 18 to July 31. The trap operated at Bar Harbor was for a biodiversity survey conducted in Acadia National Park by the Park Service.

With the exception of Steuben, all trap catches were processed at the I&DM laboratory during the season as they were received. The Steuben trap catches were processed at Steuben by Michael Roberts, the trap operator.

Roughly 25 pests are monitored on a fairly consistent basis and of these nine are compared annually (Table 3). Annual comparisons of particular species over an eight year period are included with the respective species discussions in the body of this report

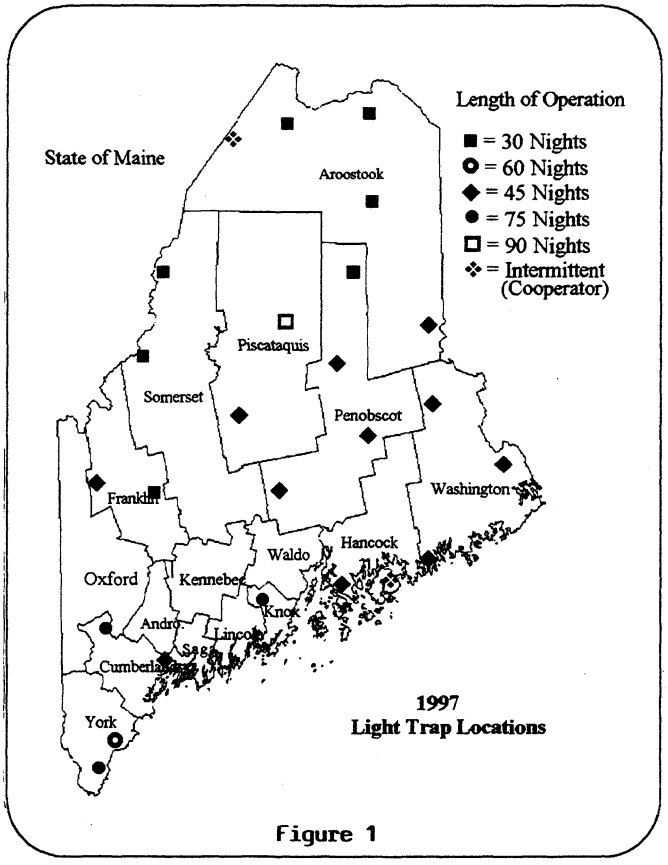

Figure 1

Table 3. Comparison summary of light trap survey collections of forest pest species, 1997

	Species								
Location	*Choristoneura conflictana*	*Choristoneura fumiferana*	*Dryocampa rubicunda*	*Heterocampa guttivata*	*Leucoma salicis*	*Lochmaeus manteo*	*Lymantria dispar*	*Malacosma disstria*	*Symmerista spp.*
Allagash	1	0	0	0	0	0	0	4	0
Arundel	4	0	208	0	2	0	0	18	3
Ashland	0	1	0	1	0	0	0	33	0
Bar Harbor*	0	0	0	0	0	3	7	0	0
Blue Hill	27	8	120	0	0	0	0	4	1
Brunswick	31	3	10	0	1	0	0	6	0
Calais	10	3	79	0	2	0	0	1	3
Chesuncook	0	2	20	13	0	2	0	0	7
Dennistown	0	0	1	0	0	0	0	10	0
Elliotsville	19	8	39	0	0	1	0	15	5
Exeter	18	4	2	0	0	3	0	1	1
Greenbush	3	0	60	1	3	14	0	41	1
Guerette	0	4	0	0	1	2	0	5	0
Haynesville	0	1	23	0	0	4	0	6	0
Kingfield	0	1	0	0	0	4	0	20	0
Millinocket	0	11	120	2	0	86	0	0	0
Mt. Vernon	8	2	3	2	0	5	0	28	9
No. Bridgton	14	5	8	0	0	1	1	9	10
Rangeley	44	8	0	0	0	0	0	2	0
Shin Pond	0	1	7	0	2	20	0	72	1
South Berwick	31	0	110	0	0	0	0	31	6
Ste. Aurelie	0	0	2	0	0	0	0	5	0
Ste. Pamphile*	29	0	2	0	0	0	0	25	0
Steuben	2	2	36	3	1	2	0	2	7
Topsfield**	0	0	0	0	0	0	0	0	0
Washington	5	5	24	0	0	4	1	16	0
Total Moths	**246**	**69**	**874**	**22**	**12**	**151**	**9**	**354**	**54**

* Intermittent cooperator operation ** Intermittent operation due to scheduling difficulty

Phenology

Few topics have generated as much discussion at the I&DM lab over the years as phenology. How to correlate biological events with climate and come up with a system that is useful for reporting and forecasting developments as well as targeting control recommendations is still a good subject for debate in forestry. While the growing degree day (GDD) system has been widely accepted in agriculture and in some of the ornamental trade, the needs of foresters are somewhat different. In 1992 we adopted as a starter, a system of fifteen Biophysical Regions (Bio. Reg.-Fig. 2) developed for Maine in 1990 by Janet S. McMahon under a grant with the Maine State Planning Office. These regions were developed using computer overlays of four sets of criteria: physiography, climate, surficial geology and soils, and vegetation and flora. Over time we had hoped to tie the volume of our phenological observations which are on file at the lab to this system. Although this has not yet been done, we have continued to use the biophysical region system in reporting and predicting various tree problems and will refer to this system in this report as well. A more elaborate and widespread system of Ecoregions developed by the USFS is based on similar divisions (see our Summary Report No. 9, March 1995, p. 12 for more information).

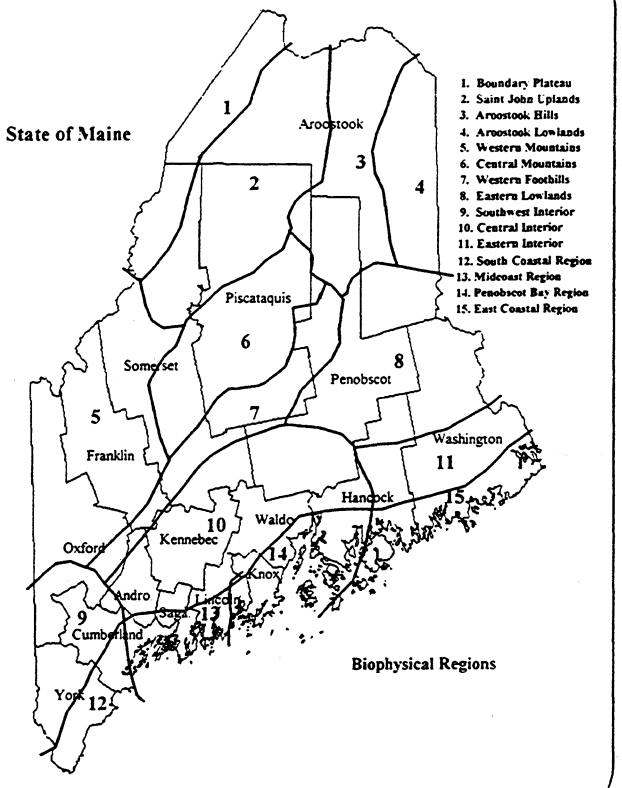

Figure 2

Maine climate and tree and pest development was variable in 1997 but with few of the striking events of previous years. Spring started wet and cool, for the most part, with snow in some areas through mid May. Even though things dried out in June, the nights were often cool (50's). By July the weather turned hot and dry and lower than normal moisture became the condition of note for the rest of the year in most areas of the state. Severe thunderstorms caused some local damage in July and early August, especially in southern Maine, but there were no hurricanes. Some tree species such as beech and eastern white pine which had been seriously impacted by the 1995 drought were further stressed by the moisture deficit in July and August. Most of Maine's forests, however, looked lush throughout the season.

INSECT Problems Associated With Trees in 1997

(A) Softwood Insect Pests

Adelgids (various) - These insects are often incorrectly referred to as aphids with which they are closely related. Adelgids are generally considered more serious tree pests than aphids and are more difficult to control as well. More than ten species of adelgids occur in Maine. Three of these; the **balsam woolly adelgid**, **eastern spruce gall adelgid** and the **pine bark adelgid** complete their entire life cycle on a single host. Most if not all of the others require two conifer hosts with a species of spruce being the gall bearing host. Among this second group it is the **Cooley spruce gall adelgid** and the **pine leaf adelgid** which generate the most concern, primarily in regard to damage to the non spruce host. The infamous **hemlock woolly adelgid** has not yet been found in Maine.

Aphids (especially *Cinara* spp.) - Aphid populations were locally high in 1997 especially later in the season. High numbers of some species such as the dark **white pine aphid** (*Cinara strobi*) were still feeding and laying eggs into early October. Although late season populations were up, early season populations were not as high or widespread as they were in 1995. The presence of flies and yellow jackets, which were attracted to the honeydew, was often the first indication of aphids. The black, elongate, bead-like aphid eggs which are laid in lines along pine needles are visible throughout the winter and provide an indication of population levels for the next season.

Arborvitae Leafminer (a complex of four species) - Populations remained high in 1997 for the third or fourth consecutive year. Although some damage was evident on many ornamental arborvitae, damage to forest stands was heaviest in Bio. Reg. 10 (Fig. 2). Damage is often most striking on columnar forms of arborvitae available in the ornamental trade. In some cases these arborvitae are so severely damaged that only a green crown or cap of foliage is left while native arborvitae nearby show only spotty damage.

Balsam Fir Sawfly (*Neodiprion abietis*) - Populations of this sawfly remained at endemic levels in 1997. No defoliation was observed.

Balsam Gall Midge (*Paradiplosis tumifex*) - Numbers of the gall midge were up in 1997 in many areas of Bio. Reg. 10 (p. 14). Christmas tree growers and wreath producers should be prepared to take action to control this insect in 1998. Balsam fir lots should be examined this winter or early spring looking first for trees with missing or 'thin' foliage and then looking closer at these trees for the presence of any remaining needle galls. These small galls occur in the basal third of the needle. Infested needles generally drop but may be still seen on or under the trees. Some which did not mature may still be attached. Application of registered pesticides to control the gall midge must be done in very late May or early June (in doubt? - err on the June side) paying particular attention to the upper third of the crowns. Note : While the same insecticides are effective for both the twig aphid and gall midge, the timing of application between the two is about three weeks apart and the only means to get good control of both is with two different applications.

Balsam Shootboring Sawfly (*Pleroneura brunneicornis*) - Populations of this sawfly were low again in 1997, so low that it was difficult to study them in the plantations where we have had study plots for the past three years (studied them to death?). There were few reports from Christmas tree growers having tip damage this past spring. In an attempt to develop a current season predictive tool, a different method was tried for trapping adult sawflies in 1997 as they emerged from the ground. Yellow sticky cards (3x5") were hung in the canopy of fraser fir trees. These inexpensive cards are easy to use and may provide a monitoring tool for plantations that have a chronic problem with the balsam shootboring sawfly. The results of the sticky card system in 1997 were inconclusive due to the low populations. Higher populations of this sawfly are needed to further develop this monitoring method.

Balsam Twig Aphid (*Mindarus abietinus*) -This pest of balsam fir is pretty much an annual concern for Christmas tree growers and those working with wreath brush. Treatment with insecticides is frequently necessary to maintain damage within acceptable levels. In forest stands, the numbers of this insect follow a predictable pattern with years of scarcity followed by a year or two of moderate tree damage then a year or two of heavy damage and a sudden drop back to scarcity again. In managed stands the populations, after initially rising to unacceptable levels, are brought in check with insecticides but often do not remain at these low levels for more than a year without continuous treatment. This is very likely due to disruption of natural predators within these stands. The end result is that balsam twig aphid populations within Christmas tree plantations must be watched annually and growers should be prepared to apply registered pesticides in early to mid May (prior to bud break) if aphids are seen.

Balsam Woolly Adelgid (*Adelges piceae*) - Few reports of the balsam woolly adelgid were received in 1997 even though the gout phase of this perennial pest is extremely common especially along the eastern Maine coast (Bio. Reg. 15). Where gouting is heaviest, partial or whole tree mortality is not uncommon. The incidence of the trunk phase was very low in 1997 and only two light and spotty gout phase infestations were observed in balsam fir Christmas tree plantations. The problem, however, bears watching.

Bark Beetles (various) - Bark beetle populations tend to fluctuate greatly in response to the availability of susceptible host trees. Although it was not difficult to find bark beetles in a variety of situations in 1997, only the **spruce beetle** seemed to cause serious, widespread damage. The **eastern larch beetle** and the **pine engraver** (*Ips pini*) were the most commonly noted of the other species.

Common Pine Shoot Beetle (*Tomicus piniperda*) - This introduced European pest of pines, sometimes called the **larger pine shoot beetle**, has still not been found in Maine.

Conifer Sawflies (various) - Although there are more than fifteen different sawflies which may occur on conifers in Maine, only three caused noticeable defoliation during the 1997 season. The **yellowheaded spruce sawfly** again dominated the scene followed by the **larch sawfly** and the **introduced pine sawfly**. Most of the remaining species produced only light or very local (often involving single trees) feeding during this period.

Cooley Spruce Gall Adelgid (*Adelges cooleyi*) - Galls of this species are fairly common on Colorado blue spruce around home grounds almost every year. Damage to Douglas fir, especially in Christmas tree plantings, continued to be a problem in 1997 as well.

Eastern Larch Beetle (*Dendroctonus simplex*) - This problem remained at relatively low levels in 1997 although larch stands exhibiting mortality due to activities of this species are still very much in evidence.

Eastern Spruce Gall Adelgid (*Adelges abietis*) - This species is probably the most abundant and destructive spruce gall adelgid in Maine and annually causes heavy gall production and shoot mortality, especially on white and Norway spruce in plantations and ornamental situations. Trees seem to exhibit varying degrees of susceptibility to this adelgid. The most susceptible trees may not die but growth will be greatly retarded and annual treatment necessary to maintain high aesthetic value. It may be best in the case of highly susceptible trees to simply remove and/or replace them.

European Pine Shoot Moth (*Rhyacionia buoliana*) - No reports of activity were received in 1997.

Fir Coneworm (*Dioryctria abietivorella*) - Tip mining activity by this species was very local in 1997.

Hemlock Borer (*Melanophila fulvoguttata*) - The hemlock borer and **Armillaria root rot** continue to take out stressed hemlock but the incidence of this secondary hemlock problem was more local and less pronounced in 1997. Declining hemlock are also frequently infested with **carpenter ants** who are simply opportunists taking advantage of ideal nesting sites in the sapwood and heartwood.

Hemlock Loopers (*Lambdina athasaria* and *L. fiscellaria*) - Larval activity by both species was endemic for the most part in 1997. Although no defoliation was observed which was attributed to the **fall-flying hemlock looper** (*L. fiscellaria*), light and very local feeding was, however, reported from the Sebago Lake area (Cumberland County) by larvae of what appears to be the **spring-flying hemlock looper** (*L. athasaria*). This would correlate with recent increases in moth activity by this species in the light trap at nearby North Bridgton (Table 4) . **Hemlock needleminer** (*Coleotechnites* spp.) activity was also up in the same area.

Table 4 . Total number of spring-flying hemlock looper *(Lambdina athasaria)* moths collected at light, 1992-1997

	Year					
Location	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
Arundel			10	0	7	1
Mount Vernon	2	7	11	5	4	3
North Bridgton	81	34	49	152	272	320
South Berwick	1	0	6	0	2	3
Washington	0	0	0	6	0	0
Total No. of Moths	**84**	**41**	**76**	**163**	**285**	**327**
Total No. of Traps	**4**	**4**	**5**	**5**	**5**	**5**

Hemlock Woolly Adelgid (*Adelges tsugae*) - This species has still not been found in Maine even though it occurs as near as northeastern Massachusetts. The Maine Forest Service and the Maine Department of Agriculture continue to closely monitor the status of this pest and maintain a joint quarantine regulating the importation of hemlock products from infested areas (**Quarantines** p. 58). Although an external quarantine was established in 1988 to prevent the introduction of this serious pest of eastern hemlock, hemlock logs can be shipped from the quarantine areas to approved Maine sites under compliance agreements. An annual survey is conducted as a means of detection and consists of visual checks of lower crowns of 3 **eastern hemlock** (*Tsuga canadensis*) in each of 1 to 7 locations per town in the vicinity of log yards and along north bound travel lanes of major entry routes in southern and mid-coastal Maine. A total of 67 sites in 32 towns in counties York, Cumberland, Sagadahoc, Lincoln, Knox, Androscoggin, and Franklin counties were checked in the spring of 1997. Sites in Farmington and Poland involve a chip mill and bark processing sites where large volumes of hemlock are processed. Nursery stock is also inspected annually. To help prevent the introduction of the hemlock woolly adelgid, hemlock nursery stock should not be brought to Maine from infested areas. Ornamental plantings in Maine which include hemlock should be checked to see if the adelgid is present. Any woolly insects on twigs or foliage should be suspect. Suspected infestations should be reported immediately to either the State Horticulturist (Me. Dept. of Agr. 28 State House Station, Phone (207) 287-3891) or MFS, I&DM (Phone (207) 287-2431). Cooperation is needed to protect our hemlock resource.

Introduced Pine Sawfly (*Diprion similis*) - The usually solitary, marbled black, green and yellow larvae of this sawfly can be found on **eastern white pine** (*Pinus strobus*) throughout the state every year but usually in low numbers overall. Such was not the case in 1997. Although feeding damage remained generally light, much higher than normal numbers were observed in September in the vicinity of pine stands in Bio. Reg. 9, 10 (western half), 12 and 13 (Fig. 3). Surprisingly feeding was not noted in most cases and little concern was expressed until the larvae descended. These larvae then wandered in great numbers over just about everything in sight in infested areas, falling or dropping their frass into swimming pools, boats, boat covers, etc. and sticking their small, tough, oval, copper-colored, cocoons to a variety of substrates. Once glued down, these cocoons were often difficult to sweep off. In some cases you could find cocoons of this sawfly stuck adjacent to the smaller, ribbed, elongate-white cocoons of the **oak skeletonizer**.

Jack Pine Sawfly (*Neodiprion pratti banksianae*) - Populations of this species remained a chronic problem in 1997 as they have for several years. Spotty defoliation of mature jack pine occurred in coastal areas of Hancock and Washington counties from Mt. Desert to Steuben. Most of the infested trees were again on rocky, poor growing sites and stunted. These trees frequently had other problems as well such as the **northern pitch twig moth** and **pine-pine gall rust** (p. 52).

Larch Casebearer (*Coleophora laricella*) - Defoliation was generally light and spotty in 1997 with a few local hot spots. Populations were down slightly from 1996 levels.

Larch Sawfly (*Pristiphora erichsonii*) - Larch sawfly populations dropped noticeably in 1997. Although it was not difficult to find individual clusters of larvae in many stands, notable defoliation (that which is visible from the air) dropped from 5,000 acres in 1996 to <710 acres in 1997 (Table 5). Most of this defoliation involved small areas of less than five acres although a few larger areas were observed in east central Maine (Fig. 4) especially in Milo and Springfield. The overall area of defoliation (all levels) was similar to that of 1996.

Table 5. Larch sawfly defoliation in 1997 by county

County	Acres
Kennebec	10
Penobscot	400
Piscataquis	200
Washington	100
Total	**710**

Mites - (See spruce spider mite p. 23)

Northern Pitch Twig Moth (*Petrova = Retinia albicapitana*) - "Gobs" of pitch containing larvae or pupae of this species were still very common and unsightly on twigs and branches of jack pine especially in Hancock and Washington counties. Most of these pitch masses were at the base of small branches or around buds. Damage by this insect is usually limited to minor twig and branch mortality and the unsightly pitch masses. This species has a two year life cycle.

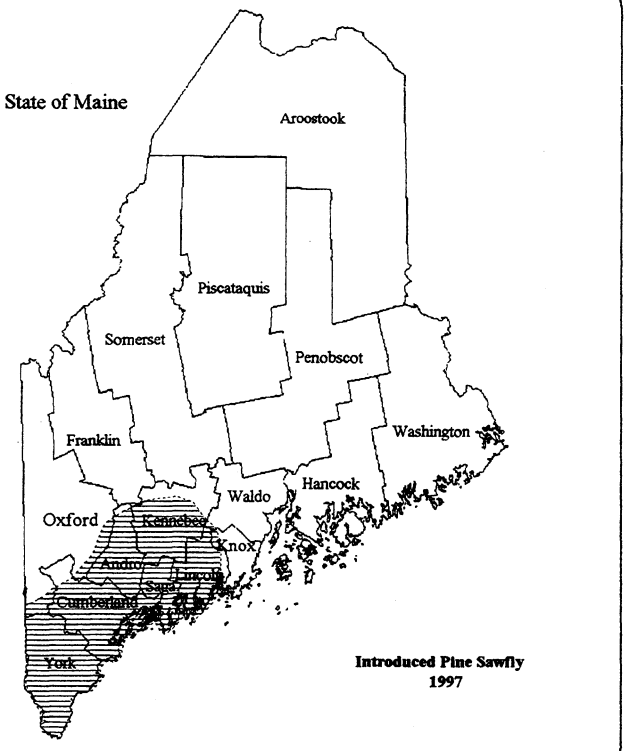

Figure 3

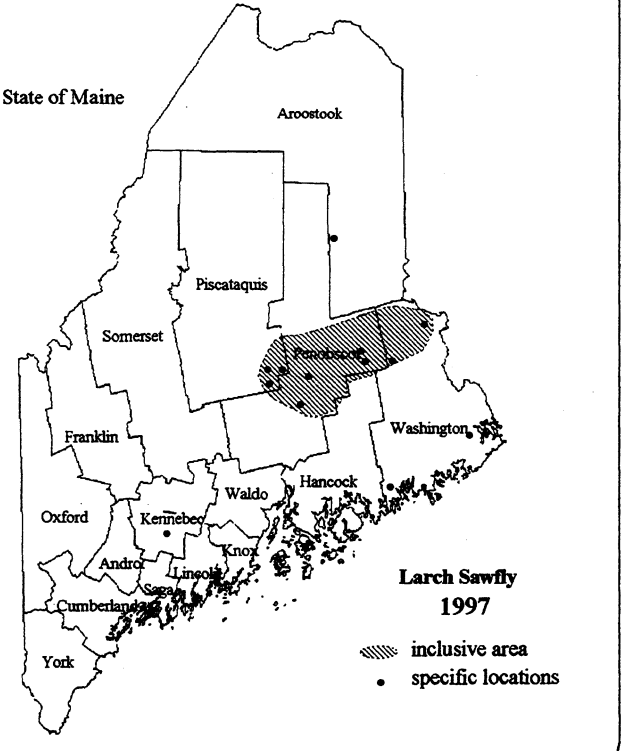

Figure 4

Pales Weevil (*Hylobius pales*) - In recent years this species has been primarily a problem involving adult feeding damage to balsam fir Christmas trees which were grown near pine, especially hard pine, cutting operations. There appears to be a resurgence of interest in the possible impact of this and associated root weevils such as the **regeneration weevil** (*Hylobius congener*) on plantings in recent cuts.

Pine Bark Adelgid (*Pineus strobi*) - This continues to be a local problem especially on stressed urban trees.

Pine False Webworm (*Acantholyda erythrocephala*) - This introduced species which has been very destructive to white and red pines over thousands of acres in upstate New York has still not appeared in Maine.

Pine Gall Weevil (*Podapion gallicola*) - This insect continues to show up wherever red pine is found. It is seldom a serious problem, however, branches of some trees may have sufficient numbers of galls to cause branch mortality.

Pine Leaf Adelgid (*Pineus pinifoliae*) - Although galls were locally common on spruce across central Maine in 1997, damage to white pine remained generally light.

Pine Needleminer (*Exoteleia pinifoliella*) - This species is primarily a pest of jack and pitch pine in Maine. Populations remained generally low again in 1997.

Pine Needle Scale (*Chionaspis pinifoliae*) - This species is a perennial pest on a wide variety of conifers. Populations always seem heaviest on Scotch and mugo pine in Maine and thus the problem is more oriented to urban and occasionally plantation situations.

Pine Root Collar Weevil (*Hylobius radicis*) - Although this species has long been purported to be in Maine we only recently have confirmed records. Over the past few years we have observed larvae and damage at the base of Scotch and red pine nursery stock resembling that of the pine root collar weevil. Soil and needles several inches out from the base of infested trees was most often saturated with pitch. In 1996 both larvae and adults were collected from the needle mat around infested Austrian pine in a plantation in Kennebunk. We are interested in any additional reports of this species in Maine.

Pine Spittlebug (*Aphrophora parallela*) - Spittle masses containing the pale yellow and black nymphs of this species were again abundant on a variety of conifers in southern Maine in 1997. Populations remained fairly stable at 1996 levels but were locally heavy on mugo, Scotch and eastern white pine. Some mugo pine in landscape situations appeared literally covered in foam. Damage was minimal.

Pitch Mass Borer (*Scynanthedon pini*) - Although infested white pine and Norway spruce were not hard to find in 1997, most were in urban or stressed settings. Populations may have stabilized.

Red Turpentine Beetle (*Dendroctonus valens*) - Several very local infestations of red pine by this beetle were observed in Cumberland County in 1997.

Saratoga Spittlebug (*Aphrophora saratogensis*) - No new infested areas were reported in 1997. Very limited areas are currently impacted by this pest in Maine.

Spruce Beetle (*Dendroctonus rufipennis*) - Spruce beetle on the islands and headlands of Maine's central coast had a banner year. In 1997 there were forty-five pockets of infestation on islands and along shorelines in Hancock, Waldo and Washington Counties (Fig. 5). As of November, 2,660 acres exhibiting 30 to 50 percent mortality and 450 acres with greater than 50 percent mortality of large spruce had been mapped. Some of the largest areas of spruce beetle infestation continue to be on Islesboro, Cape Rosier, Isle Au Haut, and on Butter, Eagle, and Great and Little Spruce Head islands. The majority of the small islands in Penobscot Bay and near Deer Isle and Mt. Desert Island have some beetle infested trees. Several stands on Deer Isle, Vinalhaven, North Haven, and Mt. Desert Island were found to be actively infested in 1997 as well.

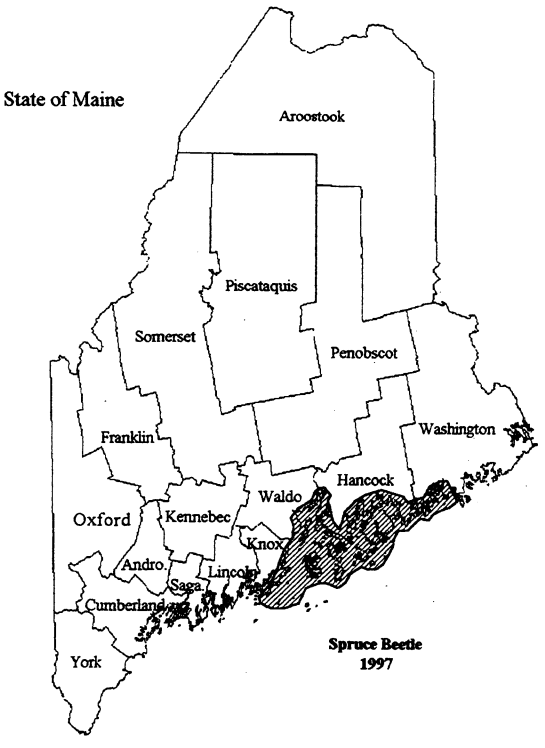

Figure 5

Although the infestation remained confined predominantly to the central Maine coast, especially Penobscot Bay, the outbreak increased significantly in terms of areas affected and intensity of attack. On many beetle infested islands, the percentage of white and red spruce trees greater than 15" dbh killed by spruce beetle increased by 15% or more in 1997. Several of the larger infested stands on the mainland shore experienced similar increases in host mortality. As of November 1997 several Penobscot Bay stands had lost more than 50% of all their red and white spruce over 15" in diameter. Scattered spruce beetle infested trees and a few larger stands have been found some distance from the shore but it is now apparent that the great majority of the currently infested area lies within a mile or two of the ocean. This pattern of infestation is correlated with the presence of large diameter spruce in the coastal zone and islands, where little stand disturbance has occurred for 60 to 100 years.

In addition to increased tree mortality in 1997, the percentage of newly attacked trees also increased significantly. On several islands beetle attack increased from scattered spots of 2 or 3 infested trees to patches where dozens of trees were infested. Several stands experienced the most intense beetle attack seen during this outbreak. Attacks were so severe in 1997 that many trees that were uninfested in the spring of 1997 were totally girdled and dead by late fall. Several areas of past beetle induced tree mortality (scattered trees killed in 1993 and 1994) that had no current beetle activity in 1995 or 1996 experienced new attacks in 1997.

In response to coastal spruce problems the Insect and Disease and Forest Policy and Management (FP&M) Divisions of the MFS have intensified efforts to notify and inform affected landowners. Two informational alerts were prepared describing the spruce beetle and general spruce problems. With the aid of the Island Institute and the Maine Coast Heritage Trust, well attended informational meetings were held in Stonington, Vinalhaven, and Bristol. I&DM and FP&M staff made numerous landowner contacts in 1997 to evaluate declining coastal spruce stands and to provide owners with information, mitigation options, and recommendations. Several landowners have begun corrective action as a result of these

contacts with the most significant salvage operations occurring on Islesboro, Eagle, and Butter Islands. Salvage opportunities on Maine's coastal islands will be limited by rapid decay and logging and transportation difficulties. Island spruces killed by spruce beetle decay soon after death and most are not suitable for salvage even after one year. The island environment is very moist and bark is usually retained on dead trees for several years. These factors provide excellent conditions for decay.

While scattered trees or small pockets of trees infested with spruce beetles could be found in other areas of northern and western Maine, the level of infestation there remains generally low.

Surveys and evaluations will continue into 1998. See also **Eastern Dwarf Mistletoe** (p. 48).

Spruce Budmoth (*Zeiraphera canadensis*) - This chronic problem affecting white spruce varies in intensity from year to year. No noticeable defoliation was observed in 1997 although larvae could be found in low numbers throughout the state.

Spruce Bud Scale (*Physokermes piceae*) - This scale often remains inconspicuous until populations reach high levels and sooty mold and discoloration of growing tips draws attention to the problem. Populations continue to remain locally high on plantation spruce throughout the state especially in Hancock, Kennebec, Waldo and Washington counties.

Spruce Budworm *(Choristoneura fumiferana)* - Since the late 1980s when the most recent spruce budworm outbreak in Maine subsided, low level populations of this insect have been monitored by field observations, a statewide light trap network (p. 12) and pheromone-baited traps that are highly attractive to budworm moths. Pheromone traps were used to monitor spruce budworm moth activity at 38 locations in 1997, 10 more sites than in 1996. Light traps were operated through the budworm flight period at 24 locations statewide (Fig. 1). Even though larval occurrence and moth catch in light and pheromone traps has been consistently very low throughout the 1990s, landowners remain interested in the status of this pest.

In 1997, very few budworm larvae were seen in insect field collections and no defoliation was detected. There was a small but widespread increase in spruce budworm moth activity in the statewide network of light traps (Table 6). Budworm moths were caught at 17 of the 24 light trap locations in 1997 compared to catches in only 10 traps in 1996. The number of budworm caught per trap increased from 2.0 in 1996 to 2.9 in 1997. The 1997 catch was the highest number of moths caught per trap since 1990. Even though the small increase in moth numbers and the more widespread catch are interesting, the 1997 survey results should be kept in perspective. During the 70's and 80's outbreak, budworm light traps had catches of thousands of moths. It is interesting to note that the 2.9 moths per trap caught in 1997 is in the range of budworm catch seen in the mid to late 60's (Table 7), four or five years prior to the onset of the most recent outbreak. If trap catch in 1997 is an indicator of a budworm upturn, catches in the next two to four years should show significant increases at least in some locations.

Moth catches in pheromone baited traps also increased (Table 8) in 1997. Budworm moths were caught in over 70% of the traps deployed. At the trap locations operated for two or more years, the moth catch per trap was five or more at four locations in 1997 as compared to only one location with five or more moths in 1996. Several trapping locations in central Maine that had been consistently low prior to last season, showed increased catches in 1997 as well. Locations along the western border that showed increased catches in 1996 continued that trend in 1997.

Pheromone and light trap catches in Maine in 1997 are still considered low, however, based on increased trap catch in 1996 and 1997, the intensified pheromone trapping grid established for budworm in 1997 (Table 8) will be continued in 1998. In addition, locations with catches of 5 or more moths in 1997 will be visited during the 1998 budworm larval development period to check for budworm activity.

Table 6 . Total number of spruce budworm (*Choristoneura fumiferana*) moths collected at light

	Year							
Location	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
Allagash	3	0	1	7	0	2	0	0
Arundel					0	3	2	0
Ashland	0	0	0	0	0	0	0	1
Bar Harbor*								0
Blue Hill	1	0	0	4	0	0	0	8
Brunswick	0	3	0	0	0	1	0	3
Calais	11	3	0	0	0	0	0	3
Chesuncook	0	1	0	1	0	0	0	2
Clayton Lake	4							
Dennistown	0	0	0	0	0	1	0	0
Elliotsville	0	0	0	2	0	1	0	8
Exeter	10	4	5	21	16	6	3	4
Greenbush	0	1	0	1	0	0	0	0
Guerette	0	0	0	0	0	0	0	4
Haynesville	1	0	0	0	2	0	2	1
Kingfield	0	0	0	2	2	0	1	1
Matagamon	0	0	1	2				
Millinocket	0	1	0	0	0	4	9	11
Mt. Vernon	1	0	0	2	1	2	12	2
No. Bridgton	0	0	1	0	0	2	0	5
Rangeley	1	0	2	8	0	1	0	8
Shin Pond					0	0	3	1
South Berwick	0	0	0	2	0	0	0	0
Ste. Aurelie	0	0	0	0	0	0	0	0
Ste. Pamphile*								0
Steuben	73	8	0	0	5	0	3	2
Topsfield**	0	0	0	0	0	1	12	0
Washington	2	0	6	0	0	0	1	5
Total Number of Moths	**107**	**21**	**16**	**52**	**26**	**24**	**48**	**69**
Total Number of Traps	**24**	**23**	**23**	**23**	**24**	**24**	**24**	**26**

* Intermittent cooperator operation ** Intermittent operation due to scheduling difficulty

Table 7. Spruce budworm seasonal light trap summary - 1961-1997

Year	Total # Moths	# Traps	Average # Moths/Trap
1997	69	26	2.6
1996	48	24	2
1995	24	24	1
1994	26	24	1.1
1993	52	23	2.3
1992	16	23	0.7
1991	21	23	0.9
1990	107	24	4.4
1989	731	22	30.7
1988	209	20	10.4
1987	464	20	23.2
1986	1,365	20	68
1985	13,233	20	661
1984	17,983	20	895
1983	144,673	18	8,037
1982	49,200	20	2,460
1981	39,724	20	1,986
1980	100,537	19	5,291
1979	95,811	16	5,988
1978	220,264	17	12,957
1977	24,212	15	1,614
1976	22,308	16	1,394
1975	149,874	23	6,516
1974	158,784	24	6,616
1973	39,069	24	1,628
1972	15,959	24	665
1971	20,653	25	826
1970	1,076	24	45
1969	5,415	27	201
1968	948	24	39.5
1967	120	26	4.6
1966	51	24	2
1965	83	24	3.5
1964	159	25	6
1963	133	24	5.5
1962	258	23	11.2
1961	763	17	44.9

Table 8. Spruce Budworm Pheromone Trap Catch in Maine - 1993 to 1997**

Location	*Year*					*Location*	*Year*				
	1993	*1994*	*1995*	*1996*	*1997*		*1993*	*1994*	*1995*	*1996*	*1997*
Allagash	5	<1	<1	1	1	Jonesboro	1	<1	<1	<1	1
Calais *	<1	<1	<1	<1	1	NE Carry	<1		<1	<1	
Chesuncook	2	<1	<1	<1	1	Princeton	2		<1	<1	1
Clayton Lake	2	<1	<1	<1	<1	Steuben *	4	2	2	<1	<1
Coburn Gore	1	<1	1	1	3	St. Pamphile	7	1	1	<1	<1
Connor	<1	<1	<1	2	<1	Topsfield *	<1	<1	<1	<1	<1
Daaquam	<1	<1	<1	1	<1	Waltham	2	4	<1	<1	1
Dennistown *	1	<1	1	2	5	Smith Pond *	3	<1	<1	<1	5
Dickey Brook *	3	<1	<1	1	<1	St Frances Lake	1	<1	2	3	3
Duck Lake	<1	<1	<1	<1		Oxbow	<1	<1	<1	1	2
Franklin		37	4	<1	3	Ragmuff	1			4	1
Garfield *	2	<1	<1	2	<1	Rangeley *	1	2	<1	3	
Greenbush *	<1	<1	<1	<1	5	Ste. Aurelie *	<1	<1	1	12	9
Haynesville *	1	<1	<1	<1	3	Matagamon ***	4	1	1	2	1
NEW TRAPS IN 1997											
Dallas Twp.					2	Magalloway					3
Edmonds					<1	Parkertown					9
Grafton					<1	Perry					1
Holeb					7	Round Pond					2
T11R9					<1	T5R16					1
T19R20					<1	T5R20					5
Baker Lk.					1						

* Light trap locations ** These figures reflect a per trap average from a cluster of three traps *** A light trap this location only in 1992 and 1993

Spruce Spider Mite (*Oligonychus ununguis*) - Mites, and in particular the spruce spider mite, are present to some degree on most conifers every year and the characteristic mottling often detracts aesthetically from otherwise lush green foliage. Populations remained generally chronic in 1997 but were locally heavy enough to warrant control on ornamental arborvitae, hemlock and spruce and in some balsam fir Christmas tree plantings.

Western Conifer Seed Bug (*Leptoglossus occidentalis*) - This species has now been collected from Maine from Yarmouth and Mt. Vernon and very likely occurs elsewhere. Although formerly a pest of seed on western conifers, populations seem to have "exploded" eastward over the past ten years. Our first Maine record was from Mt. Vernon in 1994 although the species was common there at that time. All Maine records so far involve specimens collected in homes in early October. The relatively large (3/4"+ long) and attractive adults are camouflaged brownish and seldom collected out-of-doors, however, they become easily seen after they enter homes to spend the winter. We hear that some cats like to chase them around and play with them too.

The western conifer seed bug can destroy a fairly high number of seeds within developing cones. Although their food range is wide, they seem to like pines and Douglas-fir and are especially abundant in homes in or near pine stands.

Whitemarked Tussock Moth (*Orgyia leucostigma*) - Individuals of the whitemarked tussock can be found on a variety of hosts across the state in any season. This species normally has caused at most, local defoliation in Maine over the years unlike its close cousin, the **rusty tussock** (*O. antiqua*) which has defoliated up to one hundred acres of spruce and fir in a single block in forest situations in the past. Rising populations of the whitemarked tussock in nearby Nova Scotia have placed us on alert. The whitemarked tussock defoliated >200,000 hectares of primarily balsam fir in N.S. in 1997 and more defoliation is expected in 1998. Christmas tree growers should be especially watchful for this pest which has a taste for balsam fir. Infested trees would be unsaleable. So far we have not detected a problem of this magnitude this side of the border but will be watching.

White Pine Weevil (*Pissodes strobi*) - The white pine weevil is undoubtedly the most economically damaging pest of white pine in Maine, rivaled only by **white pine blister rust** (p. 55). This is one of those chronic problems in most areas and seriously limits growth of good straight white pine unless controlled. Young trees (three to 30 feet in height) normally bear the highest incidence of attack. Although weevil populations remain fairly stable at high levels; annually visible new damage to high value stock fluctuates, due in part to limited availability or improper use of effective, registered pesticides. Corrective pruning will help in the case of ornamental white pine as well as Colorado blue and Norway spruce.

Yellowheaded Spruce Sawfly (*Pikonema alaskensis*) The yellowheaded spruce sawfly (YHSS) is a native insect whose damage over the years has been light and spotty. Previous outbreaks requiring control have generally been less than ten acres in size except for one outbreak in coastal areas near Bath between 1947 and 1949 which required control measures in mature stands. Over the past few years however, populations have increased to where they are impacting spruce growth in a number of plantations across the state. This is especially true in black spruce plantations where the open growth of young trees (3-10 yrs. old) favors sawfly development. An estimated 3,500 acres of spruce in forest situations exhibited damage by YHSS in 1997. Moderate to heavy damage could be found in many black spruce plantations in Franklin (1,000 acres) and Somerset (1,500 acres) counties and sawfly populations are on the rise in central Penobscot (500 acres) and southern Aroostook (500 acres) counties (Fig. 6). Elsewhere the damage was primarily restricted to ornamental and roadside trees.

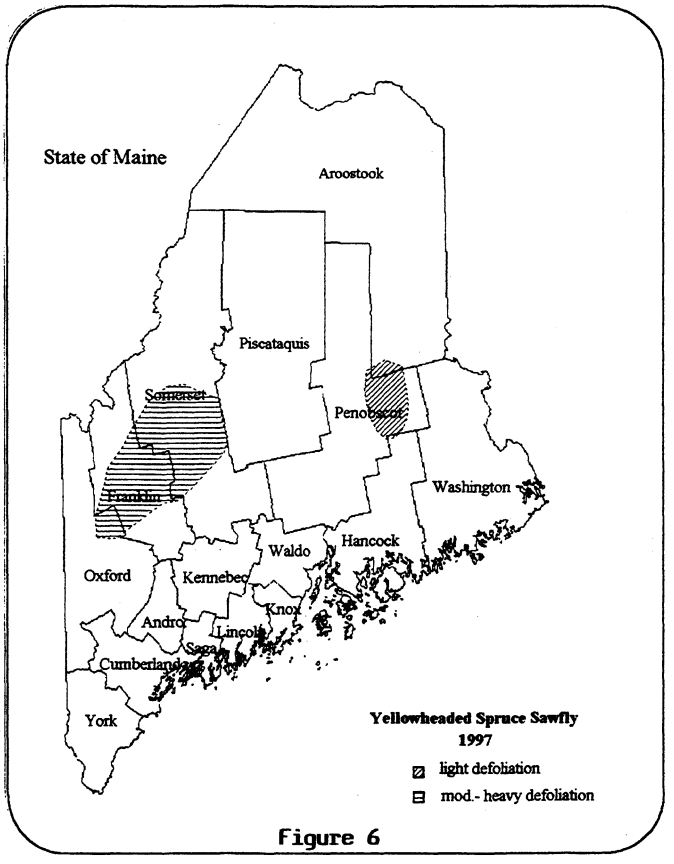

Figure 6

The MFS surveyed spruce across the state in 1996 and also provided concerned landowners with training for foresters on sawfly biology, damage and assessment. The landowners checked their spruce holdings to identify plantations that would need protection from the sawfly. In 1997 three townships in western Maine had sufficient acreage damaged by YHSS to warrant aerial spray intervention. A total of 1,123 acres were considered at risk of further growth loss and tree mortality; 530 acres in Carrying Place Town, 326 acres in Coplin, and 267 acres in Mt. Abram. The MFS provided technical support in determining YHSS population levels and development in affected areas (p. 4) and agreed to assess the efficacy of the project. Landowners applied carbaryl (Sevin XLR Plus) to 1,098 acres. The remaining 25 acres were sprayed with either Neemix or Fortune Aza, botanical derivatives from neem trees, as part of an experimental project (p. 6). The carbaryl effectively controlled the yellowheaded spruce sawfly and the plantations appear to be recovering from the damage. The neem products were not successful in significantly suppressing the populations of yellowheaded spruce sawfly (p. 6).

Areas of moderate damage in 1995 and 1996 continued to have damage this year whereas some areas that had low levels of sawfly had no damage in 1997. The sawfly will probably be at damaging levels again in 1998 where it has been a problem in the past.

(B) Hardwood Insect Pests

NOTE: This section includes all insect pests of deciduous trees and shrubs in forest, ornamental and urban settings

Alder Insects - Browning of alder was spotty in 1997 with little change from 1996. The most common defoliator was the **alder flea beetle** (*Altica ambiens alni*) although flea beetles were often aided by the **alder leaf beetle** (*Chrysomela mainensis mainensis*), **Alder sawfly** (*Arge* sp.) and the **spotted tussock** (*Lophocampa maculata*).

Aphids - Aphids on deciduous trees are seldom noticed until your recently clean car appears to be covered with sticky spots as it sets in the shade. Aphid populations appeared to be stable in 1997 with locally higher numbers. Most commonly noted were several species of early feeding **birch aphids** (? spp.) and the **black-bordered oak aphid** (*Myzocallis ? neoborealis*). The **woolly alder aphid** (*Paraprociphilus tessellatus*) was very evident on alder stems in many areas in 1997 but no infestations of silver maple were observed.

Ash Defoliators (various) - The condition of ash throughout much of the state continued to improve generally in 1997 and pest populations appeared to be down. Ash in coastal areas around the western shore of Penobscot Bay exhibited a noticeable but stable level of browning from the activities of **ash leaf and twig rust** (p. 43) in concert with a number of insects. Of the insects causing ash defoliation in 1997 the **fall webworm** (*Hyphantria cunea*) was again the most predominant and widespread.

Asian Longhorned Beetle (*Anoplophora glabripennis*) - This potentially serious woodboring pest of deciduous trees, especially maples, HAS NOT BEEN FOUND IN MAINE. It is not known to be established anywhere in North America except in the New York City area. Early detection of any infestation by this beetle/woodborer is critical - so watch for it and report any signs of possible activity to the I&D Lab in Augusta. And do not import hardwood firewood from New York City (believe it or not this has been done)!

Aspen Problems (various) - Aspen stands remained green throughout the season in most areas in 1997. This was in stark contrast to the widespread thin and off-color condition experienced over the past several years. Although the **aspen leafroller** (*Pseudexentera oregonana*) and **large aspen tortrix** were present in many stands, defoliation was light.

Bark Beetles and Ambrosia Beetles (Scolytidae) - Damage to standing hardwood trees by species of Scolytidae has been generally low in Maine over the years with the notable exception of that caused to American elm by the **native elm bark beetle** (*Hylurgopinus rufipes*) and the **smaller European elm bark beetle** (*Scolytus multistriatus*). Degrade of birch, maple and oak lumber due to activities of several species of **ambrosia beetles** occurs but the reported incidence is spotty. The **eastern ash bark beetle** (*Hylesinus aculeatus*) continues to be primarily a problem related to firewood in the home.

Barklice or Psocids - "Herds" of these interesting "little cattle" are often very noticeable on the bark of various trees across much of Maine. Although colonies are usually more abundant and evident on hardwoods, they also occur on a variety of softwoods as well. The psocid species most commonly noticed in numbers on tree bark in Maine is *Cerastipsocus venosus*. Barklice feed on lichens and fungi on the tree bark and pose no threat to the trees themselves.

Beech Problems (various) - Although beech stands across the state continue to exhibit relatively high numbers of severely stressed or dying trees, the condition overall stabilized somewhat in 1997 after several years of steady decline (see **hardwood decline** p. 50). Although the **beech bark disease** component continues to be a major stressor, beech decline accelerated following the 1995 **drought**. . Dry conditions throughout much of the area involved in 1997 may add another level of stress which could begin to manifest itself in 1998. **Beech bark disease**, an introduced problem, involves an insect/fungus complex (Insect scales/*Nectria* spp.) which stresses, deforms and kills beech. It occurs statewide but varies locally and annually at least in intensity of expression. Although the **beech scale** (*Cryptococcus fagisuga*) appears to be the most common scale involved, the **birch margarodid** (*Xylococculus betulae*) is also an important component of the complex. In recent years another scale, the **oystershell scale** (p. 33), has added another factor to this complex. Fortunately, some relief comes from the feeding activities of the black, red-spotted, **twicestabbed lady beetle** (*Chilocorus stigma*) whose hunger for scales helps to significantly reduce scale populations. Populations of defoliators such as the **variable oakleaf caterpillar** (p. 35), which have added another layer of stress in recent years, were low in 1997.

Birch Casebearer (*Coleophora serratella*) - Defoliation by the birch casebearer declined in Maine in 1997 for the second consecutive year.

Birch Leafminer (*Messa nana*) - Mines of the birch leafminer were very evident in 1997 on white birch locally in Bio. Reg. 10, 14 & 15 and to a lesser degree elsewhere (Fig. 7). Populations were up slightly as expected. Populations of the **gray birch leafminer** (*Fenusa pusilla*) were also up slightly in some areas.

Birch Skeletonizer (*Bucculatrix canadensisella*) - Populations and damage from this species remained low in 1997.

Bronze Birch Borer (*Agrilus anxius*) - Dead-topped birch resulting from stem boring activities of larvae this insect continue to show up where stress of one kind or another exists. Birch on drought-prone sites, recently thinned woodlots and "abused" landscape situations are most susceptible. Once birch are infested with this borer there is little that can be done to prevent eventual tree mortality.

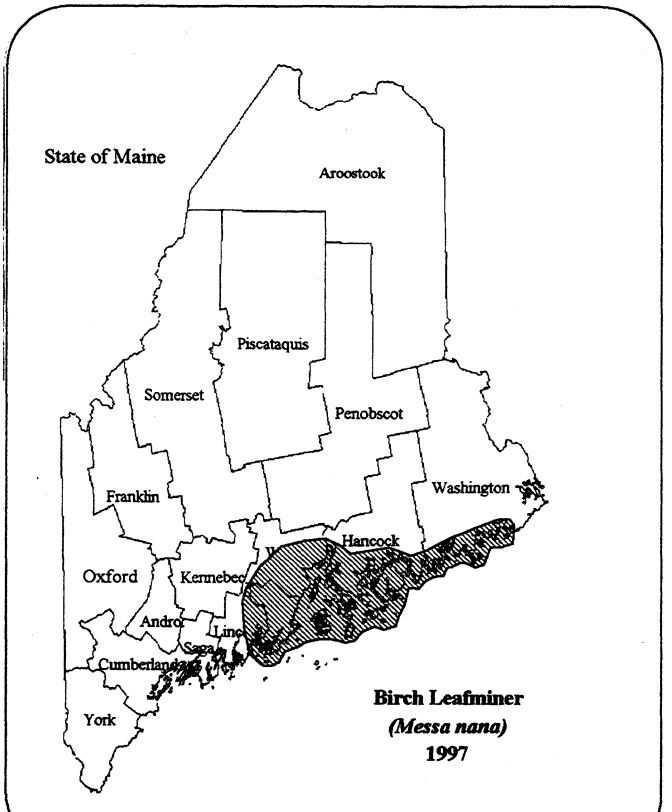

Figure 7

Browntail Moth (*Euproctis chrysorrhoea*) - The browntail moth continued to be a serious problem on coastal islands and mainland sites in and around Casco Bay (Cumberland County) in 1997 (Fig. 8). Larval activity resulted in the defoliation of various hardwoods and both dermal and respiratory problems for residents of these areas. The islands within Casco Bay generally continued to support high population levels although some of the areas, i.e. Long Island, exhibited a reduction in intensity of the infestation. Just a note of interest - 1997 was the first year the browntail moth was found on Monhegan Island during the current outbreak. Exceptionally high moth activity was observed in mid July in the Bay area and to the north and east. Light poles in some sections of Yarmouth and Freeport were white with moths around July 17th. Moths may have moved with frontal weather systems as they moved eastward.

much further eastward late in the season indicating an expansion of the area generally infested (Fig. 8). This bears watching in 1998.

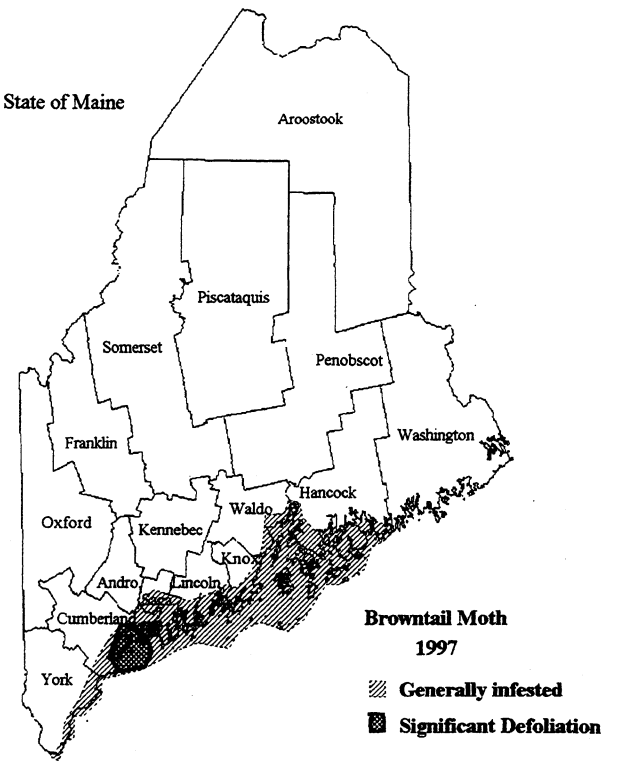

Figure 8

Numerous control projects were done in 1997 ranging from a very active clipping effort on Cliff Island (10,000+ webs destroyed) to a 500 acre aerial application of diflubenzuron (Dimilin 4L) contracted by the City of Portland. Many homeowners had their lots treated with various registered insecticides, such as diflubenzuron, cyfluthrin (Tempo) and carbaryl (Sevin) by arborists using ground based sprayers, either hydraulic or mist blowers. The aerial application of 1 ounce of Dimilin 4L per acre was done on May 27 and 28 on portions of Cousins, Cushing, Little Diamond and Peaks Islands totaling 500 acres with residents reporting very satisfactory control in all locations. Another 100 acres in two areas (60 and 40 acres respectively) on the mainland were treated privately with Dimilin as well.

Applications of tebufenozide (Mimic) and *Bacillus thuringiensis* (Bt) were tested against the browntail to develop alternative pesticides which pose lower risk to non target marine animals. Tebufenozide, an insect growth regulator (IGR) with a narrow host spectrum, was applied in May in two different sites using backpack and truck mounted mist blowers. Excellent control of the browntail moth was achieved using 0.12 lb. a.i. per acre. Bt trials included Foray 48F with MVP II (5.3:1 mix ratio), Condor 0F with MVP II (5.3:1 mix ratio), and MVP II only. Control with both combinations resulted in acceptable levels of control (>60%) whereas the MVP II treatment was not different from the untreated controls. Work is currently underway to register tebufenozide and laboratory work is continuing to find the ideal ratio of Foray/Condor to MVP II. Both products are expected to be tested again in the spring of 1998 using aerial applications.

An aerial survey of hardwood defoliation resulting from the feeding by the larvae of the browntail moth was done in late June to record the extent and intensity of the 1997 infestation. The total acreage showing >30% defoliation dropped from 3,081 acres in 1996 to 2,150 acres in 1997. Most of this decrease was on islands within the bay while the level of defoliation actually increased on the mainland, particularly in Cumberland. On the islands the browntail moth population has gone through a large shift with a heavy increase into the northeast end of Casco Bay (Merepoint, Brunswick and Bailey Island) and a decrease on many of the islands hardest hit in previous years to the south (Cushing, Long and the Diamonds).

Numerous residents or visitors to infested areas suffered from a severe rash as a result of contact with the poisonous hairs found on the larvae of the browntail moth again in 1997. The level of human discomfort in infested areas usually peaks at the time of pupation in late June and early July and tapers off as the hairs become lodged on the ground as a result of rainfall. A lack of rainfall during this period in 1997 allowed the hairs to remain on foliage and windy conditions kept moving the hairs about causing an extended period of discomfort for many people within the infested areas. While antihistamines may reduce the discomfort for some individuals, no one form of treatment seems to be universal, so it is recommended that people with severe rash or respiratory distress seek the advice of their family physician.

The outlook for 1998 browntail moth populations is for continued spread to the north and east while the population remains stable in areas which supported moderate to high levels in 1997. Winter surveys for the overwintering webs of this insect are underway and, to date, webs have been found as far east as Gouldsboro. Coastal towns south of Portland continue to support low numbers of this pest but, to date, no sites have been located in this region which have sufficient populations to warrant the use of chemical control measures. Plans are underway for control projects in 1998 scattered from Portland to Bailey Island (Harpswell). Homeowners will be well advised to check trees and shrubs around their homes for the presence of the overwintering webs of the browntail moth prior to April to allow time to either clip and destroy the webs or to make arrangements with a licensed pesticide applicator to control the larvae.

Bruce Spanworm (*Operophtera bruceata*) - Populations were noticeably lower in 1997 than in 1996 with less than 1,000 acres of mappable defoliation. Most of this involved understory trees in small pockets widely scattered across central Maine.

Butternut Problems (various) - The condition of butternut in Maine seems to have declined in recent years due to a number of problems. Although butternut occurs in all Maine counties, it reaches the northern limits of its range in this state. It is probably for this reason that most trees do not reach their full stature and suffer more from stress. The **butternut canker** (p. 45) has added a further burden compounded by insect depredations. The **butternut woollyworm** (*Eriocampa juglandis*) and **lace bugs** locally affect tree appearance on an annual basis. Over the past couple of years however, there have been increasing reports of heavier defoliation by **sawfly** larvae (? spp.), **tubemakers** (*Acrobasis* sp.) and at least two species of small **weevils** (unidentified Curculionidae). The most extensive defoliation in 1997 affected trees over several acres along Rte. 150 north of Guilford. Many trees in this area were totally stripped again in early June.

Eastern Tent Caterpillar (*Malacosoma americana*) - This tent maker on roadside and hedgerow cherry started off with a "bang!," but populations seemed to collapse early. By the first of June only scattered tents were obvious in most areas where many starts were reported. Some tents appeared to have been torn apart possibly by hungry birds looking for a meal!

Elm Flea Beetle (*Altica carinata*) and Elm Leaf Beetle (*Pyrrhalta luteola*) - Defoliation of elm by either or both of these species was low and local in 1997.

Fall Cankerworm (*Alsophila pometaria*) - The only notable activity by this species continues to be on boxelder in eastern Aroostook County. This infestation was low and spotty in 1997.

Fall Webworm (*Hyphantria cunea*) - This species was again abundant in many areas of the state in 1997 especially in northern and eastern Maine. Although this late season (August) tent maker has been considered primarily a nuisance there is some evidence of at least some branch mortality on ash which have been heavily defoliated for two or more years.

Forest Tent Caterpillar (*Malacosoma disstria*) - Populations of the forest tent remained low in 1997 and no defoliation was observed. Moth catches continued to decline in the light trap survey (Table 9) and larvae were less visible in 1997 than in 1996.

Table 9. Total number of forest tent caterpillar (*Malacosoma disstria*) moths collected at light

	Year							
Location	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
Allagash	65	39	54	78	64	27	8	4
Arundel					82	150	39	18
Ashland	110	122	124	169	117	157	57	33
Bar Harbor*								0
Blue Hill	20	27	43	47	221	62	17	4
Brunswick	54	69	17	9	35	32	33	6
Calais	7	11	23	279	52	28	3	1
Chesuncook	0	0	1	0	2	1	0	0
Clayton Lake	7							
Dennistown	45	37	58	44	89	79	10	10
Elliotsville	36	49	78	55	53	145	18	15
Exeter	1	1	2	1	8	4	0	1
Greenbush	44	56	24	30	87	95	149	41
Guerette	20	28	8	12	32	18	4	5
Haynesville	45	56	36	45	176	64	9	6
Kingfield	1	4	18	20	97	95	32	20
Matagamon	46	63	126	56				
Millinocket	14	20	43	7	73	75	0	0
Mt. Vernon	39	32	107	39	187	192	46	28
No. Bridgton	90	115	153	297	223	102	51	9
Rangeley	1	81	47	48	57	11	3	2
Shin Pond					124	217	30	72
South Berwick	245	352	324	377	371	195	91	31
Ste. Aurelie	6	18	13	9	28	15	6	5
Ste. Pamphile*								25
Steuben	8	9	0	2	169	11	7	2
Topsfield**	33	28	45	102	178	40	14	0
Washington	31	23	36	53	111	41	45	16
Total Number of Moths	**968**	**1,240**	**1,380**	**1,779**	**2,636**	**1,856**	**672**	**354**
Total Number of Traps	**24**	**23**	**23**	**23**	**24**	**24**	**24**	**26**

* Intermittent cooperator operation ** Intermittent operation due to scheduling difficulty

Greenstriped Mapleworm (*Dryocampa rubicunda*) - Larval populations of this species remained low in 1997 and no defoliation was reported. This species is primarily a feeder on red maple in Maine. Numbers of the familiar pink and yellow adults, the **rosy maple moth**, rose slightly in 1997 (Table10).

Table 10. Total number of greenstriped mapleworm (*Dryocampa rubicunda*) moths collected at light

	Year							
Location	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
Allagash	0	0	0	2	0	0	0	0
Arundel					468	531	130	208
Ashland	0	0	0	1	0	0	0	0
Bar Harbor*								0
Blue Hill	115	24	46	104	46	113	30	120
Brunswick	20	13	16	4	27	20	8	10
Calais	20	7	4	13	29	240	19	79
Chesuncook	10	4	1	3	8	51	3	20
Clayton Lake	0							
Dennistown	1	0	1	1	5	1	2	1
Elliotsville	58	7	11	14	30	103	18	39
Exeter	6	1	1	3	9	7	2	2
Greenbush	16	10	12	13	14	48	34	60
Guerette	0	0	0	0	0	0		0
Haynesville	5	8	2	8	12	34	5	23
Kingfield	0	0	0	0	0	0	4	0
Matagamon	0	0	0	0				
Millinocket	61	8	27	38	66	93	23	120
Mt. Vernon	2	24	18	5	11	32	16	3
No. Bridgton	2	4	6	2	6	24	20	8
Rangeley	0	0	0	1	0	0	0	0
Shin Pond					0	1	1	7
South Berwick	95	41	373	340	189	276	171	110
Ste. Aurelie	0	0	0	0	0	0	1	2
Ste. Pamphile*								2
Steuben	14	42	84	22	33	56	11	36
Topsfield**	17	20	12	31	37	133	24	0
Washington	7	89	48	90	101	181	34	24
Total Number of Moths	**449**	**302**	**662**	**695**	**1,091**	**1,944**	**556**	**874**
Total Number of Traps	**24**	**23**	**23**	**23**	**24**	**24**	**24**	**26**

* Intermittent cooperator operation ** Intermittent operation due to scheduling difficulty

Gypsy Moth (*Lymantria dispar*) - Gypsy moth populations remained at endemic levels in all counties of Maine in 1997. Very low numbers of larvae, male moths and egg masses could be found locally throughout much of the infested area in 1997 but no significant population increases are expected in 1998. The only

noticeable infestation was a small pocket of <50 acres on Mt. Desert Island where larvae of gypsy moth were cohabiting with a complex involving the **maple leafcutter** and **variable oakleaf caterpillar**. Defoliation from this complex ranged up to 100% within the infested stand (note also light trap records for moths in Bar Harbor (Table 11) but the amount attributable to any one species was difficult to determine.

Due to the low populations overall, it was difficult to collect egg masses for overwintering survival and parasite surveys. The few egg masses which were collected yielded inconclusive results. Data from pheromone trapping surveys indicated no significant populations and the numbers of moths collected in the light trap survey also remained low in 1997 (Table 11). The **Asian gypsy moth** has still not been found in Maine.

Table 11. Total male gypsy moths *(Lymantria dispar)* collected at light

	Year							
Location	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
Allagash	0	0	0	0	0	0	0	0
Arundel					0	1	0	0
Ashland	0	0	0	0	0	0	0	0
Bar Harbor*								7
Blue Hill	0	0	0	1	4	0	0	0
Brunswick	20	220	6	0	0	0	0	0
Calais	0	2	5	0	0	0	0	0
Chesuncook	0	0	0	0	0	0	0	0
Clayton Lake	0							
Dennistown	0	0	0	0	0	0	0	0
Elliotsville	0	0	0	0	0	0	0	0
Exeter	0	3	0	0	0	0	1	0
Greenbush	0	0	29	0	0	0	0	0
Guerette	0	0	0	0	0	0	0	0
Haynesville	0	0	0	0	0	0	0	0
Kingfield	0	0	0	0	0	0	0	0
Matagamon	0	0	0	0				
Millinocket	0	4	0	1	7	0	2	0
Mt. Vernon	15	142	78	1	27	12	0	0
No. Bridgton	156	213	17	1	2	0	0	1
Rangeley	1	0	0	0	0	0	0	0
Shin Pond					0	0	0	0
South Berwick	29	191	315	153	4	23	1	0
Ste. Aurelie	0	0	0	0	0	0	0	0
Ste. Pamphile*								0
Steuben	0	1	3	0	0	0	0	0
Topsfield**	0	2	1	2	0	0	0	0
Washington	0	13	19	0	0	0	0	1
Total Number of Moths	**221**	**791**	**473**	**159**	**44**	**36**	**4**	**9**
Total Number of Traps	**24**	**23**	**23**	**23**	**24**	**24**	**24**	**26**

* Intermittent cooperator operation ** Intermittent operation due to scheduling difficulty

As gypsy moth populations are currently at a low ebb we felt that this might be the time to reflect on population fluctuations of this introduced insect over the years using the only consistent figure available for comparison, acres of defoliation. Keep in mind that methods used to derive acreage figures over the years have varied somewhat with regard to defoliation categories used, observer and observation methods. Table 12 will give you some idea of the dynamics of the problem in Maine. Although the USDA/APHIS/PPQ has been consistently involved with the gypsy moth problem over the years, all state work was conducted by the Maine Dept. of Agriculture until 1954. The 96th Maine State Legislature transferred both gypsy moth and browntail moth assessment and control activities to the Maine Forest Service, effective August 8, 1953.

Table 12. Total acres defoliated by gypsy moth in Maine year from 1924 to 1997*

Year	Acres Defoliated	Year	Acres Defoliated	Year	Acres Defoliated	Year	Acres Defoliated
1924	0.71	1943	10	1962	5,198	1981	655,841
1925	-	1944	21,221	1963	1,970	1982	578,220
1926	1	1945	210,881	1964	<100	1983	26,353
1927	4,985	1946	203,813	1965	<100	1984	4,881
1928	5,575	1947	-	1966	30	1985	10,496
1929	15,187	1948	60	1967	825	1986	13,697
1930	55,174	1949	-	1968	777	1987	849
1931	20,938	1950	2	1969	460	1988	100
1932	42,298	1951	8,195	1970	1,080	1989	34,280
1933	19,718	1952	82,715	1971	820	1990	270,432
1934	60,403	1953	174,999	1972	40	1991	620,933
1935	92,630	1954	170,485	1973	490	1992	278,485
1936	80,944	1955	10,810	1974	860	1993	50,694
1937	140,026	1956	7,285	1975	110	1994	1,706
1938	120,432	1957	120	1976	100	1995	0
1939	202,193	1958	-	1977	2,010	1996	100
1940	204,041	1959	1,000	1978	4,120	1997	<100
1941	122,386	1960	6,350	1979	23,350		
1942	850	1961	41,245	1980	223,810		

* Acreage figures used in this table for 1924 to 1960 were taken from USDA/APHIS/PPQ records. From 1960 to 1997 records are from I&DM files. The presence of a hyphen (-) generally indicates no detectable defoliation for the year.

Hunter's Moths (adults of several species of cankerworms) - The adults of a number of species of loopers/cankerworms fly late in the season from September through November. Over the years these have come to be known as **hunter's moths** as they are daytime fliers during hunting season. During the fall of 1997 activity was spotty. Species included in this group are: **Bruce spanworm, fall cankerworm** and **fall-flying hemlock looper**.

Lace Bugs (*Corythucha* spp.) - Lace bug populations were higher than usual in 1997 especially on birches and butternut. The tiny nymphs, and lacy adults accompanied by an assortment of cast skins and waste material (frass) gave a messy appearance to the undersurface of infested leaves. Heavy feeding caused foliage to become yellow and mottled by July.

Large Aspen Tortrix (*Choristoneura conflictana*) - No defoliation specifically attributable to large aspen tortrix was detected with either ground or aerial surveys in 1997. Larvae were fairly common in some stands, however. Surprisingly, moth numbers rose quite noticeably in our light trap survey (Table 13) in 1997 which may portend increased defoliation in 1998.

Table 13. Total number of large aspen tortrix (*Choristoneura conflictana*) moths collected at light

	Year							
Location	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
Allagash	13	1	0	5	0	0	1	1
Arundel					0	12	1	4
Ashland	10	0	0	0	0	0	3	0
Bar Harbor*								0
Blue Hill	0	3	14	2	1	5	2	27
Brunswick	0	0	3	0	0	0	2	31
Calais	6	14	2	0	0	0	0	10
Chesuncook	0	0	0	0	0	0	0	0
Clayton Lake	7							
Dennistown	974	0	0	2	0	1	0	0
Elliotsville	159	33	42	14	0	2	17	19
Exeter	0	5	4	15	6	12	3	18
Greenbush	2	25	28	29	0	0	0	3
Guerette	0	1	0	0	2	0	0	0
Haynesville	15	257	3	0	0	0	0	0
Kingfield	2	0	3	0	0	0	0	0
Matagamon	0	0	3	0				
Millinocket	11	14	5	0	0	3	1	0
Mt. Vernon	1	4	2	2	0	5	2	8
No. Bridgton	0	0	2	0	0	2	0	14
Rangeley	1	5	47	92	0	13	14	44
Shin Pond					1	0	0	0
South Berwick	0	3	4	0	0	0	2	31
Ste. Aurelie	8	0	0	1	0	0	0	0
Ste. Pamphile*								29
Steuben	0	4	2	1	0	0	0	2
Topsfield**	42	20	15	1	0	0	4	0
Washington	0	0	14	0	0	2	6	5
Total Number of Moths	**1,251**	**389**	**193**	**164**	**10**	**57**	**58**	**246**
Total Number of Traps	**24**	**23**	**23**	**23**	**24**	**24**	**24**	**26**

* Intermittent cooperator operation ** Intermittent operation due to scheduling difficulty

Locust Leafminer (*Odontota dorsalis*) - Black locust throughout much of southern Maine south of Lincoln and west of Machias showed varying degrees of rusty foliage, the result of leaf mining activities of larvae of this species in 1997.

Maple Leafcutter (*Paraclemensia acerifoliella*) - Populations of the maple leafcutter on sugar maple remained relatively high in 1997 although the area exhibiting severe (100%) defoliation was smaller. The total area of visible defoliation expanded from 100 acres in 1996 to nearly 200 acres in 1997. The heaviest defoliation in 1997 occurred in northern York County except for one isolated stand on Mt. Desert Island in Hancock County.

The area of severe damage in York County dropped from 40 acres in 1996 to <25 acres in 1997. Within this and adjacent sugarbushes, however, the area of light to moderate defoliation increased. Along with the maple leafcutter in this area we also saw high numbers of other late season defoliators of sugar maple such as the **maple trumpet skeletonizer** (*Epinotia aceriella*) and **maple webworm** (*Tetralopha asperatella*). Late season pests such as these usually are not a problem unless late refoliation occurs or if there are three or more successive years of high populations.

The area of infestation on Mt. Desert Island encompassed <100 acres in one isolated area of which <30 acres exhibited severe defoliation. In this stand larvae of the **gypsy moth**, **variable oakleaf caterpillar** and **flat leaftier** (*Psilocorsis* sp.) replaced the **skeletonizer** and **webworm** and were very abundant, producing stiff competition for green foliage. Within this stand it was interesting to note that the green, unifested red maple produced a stark contrast to the brown of beech, birch and sugar maple.

Maple Leafroller (*Sparganothis acerivorana*) - Populations of maple leafroller remained low again in 1997 and no defoliation of its preferred Maine host, red maple, was observed.

Mountain Ash Sawfly (*Pristiphora geniculata*) - This introduced species is on our list of perennial problems affecting ornamental mountain ash. The 1997 season was no exception with the usual complaints in spite of the fact that control of the problem is easy to achieve. This sawfly is seldom a problem on native mountain ash in the wild.

Oak Leaf Shot-hole Fly (*Japanagromyza viridula*) - No defoliation by this species was observed in 1997. Fly populations, emergence and bud expansion must be in sync for damage to occur.

Oak Leaftier (Shredder) (*Croesia semipurpurana*), **oak leafroller** (*Archips semiferana*), **oak skeletonizer**, **oak trumpet skeletonizer** (*Epinotia timidella*), **leaf galls** (various) and the **oak webworm** (*Archips fervidanus*) caused off-color and "ratty" foliage locally throughout southwestern Maine and locally elsewhere in August and September of 1997. The skeletonizers appeared to be to most serious culprits often browning as much as 30% of the foliage.

Oak Sawflies (various) - Oak sawfly larval feeding remained light and local in 1997.

Oak Skeletonizer (*Bucculatrix ainsliella*) - Second generation larval feeding by the oak skeletonizer produced generally light but locally visible defoliation in August and early September in 1997. Larval numbers, however, were striking in some oak stands in Bio. Reg. 9, 10, 12 and 13 especially as they spun down from infested trees between mid August and mid September to pupate. They were often unwelcome and uninvited guests at late season cookouts. The tiny, elongate, white, ribbed silken cocoons which soon appeared were attached to a wide variety of substrates and were often mixed with the larger brownish cocoons of the **introduced pine sawfly**. Adults of both will emerge in the spring. Some Christmas trees and wreaths "sported" numbers of these cocoons.

Oak Twig Pruner (*Anelaphus* spp.) - Infested branches of northern red oak began to droop in early July this season but appeared less noticeable than in 1996.

Orangehumped Mapleworm (*Symmerista leucitys*) - Populations of this species were low in 1997 and no defoliation was observed. Numbers of moths of *Symmerista* spp. caught in our annual light trap survey were also low (Table 14).

Table 14. Total number of *Symmerista* spp. moths collected at light

	Year							
Location	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
Allagash	0	0	0	0	0	0	0	0
Arundel					4	3	3	3
Ashland	0	0	0	0	0	2	1	0
Bar Harbor*								0
Blue Hill	0	0	1	6	32	33	7	1
Brunswick	4	8	0	1	5	17	3	0
Calais	5	1	3	0	0	41	13	3
Chesuncook	1	0	0	1	2	20	3	7
Clayton Lake	0							
Dennistown	0	1	0	0	0	0	0	0
Elliotsville	44	10	5	4	1	50	2	5
Exeter	0	1	0	1	3	15	7	1
Greenbush	3	0	0	0	0	10	3	1
Guerette	0	0	0	0	0	0	0	0
Haynesville	1	0	0	0	0	2	1	0
Kingfield	0	0	0	0	0	5	0	0
Matagamon	2	0	0	0				
Millinocket	9	0	0	0	0	4	0	0
Mt. Vernon	3	2	4	4	23	141	42	9
No. Bridgton	3	10	8	21	12	73	7	10
Rangeley	0	1	0	0	0	2	3	0
Shin Pond					0	26	1	1
South Berwick	18	13	30	4	1	5	3	6
Ste. Aurelie	0	0	0	0	3	0	0	0
Ste. Pamphile*								0
Steuben	0	7	0	0	3	13	7	7
Topsfield**	67	5	3	0	13	152	11	0
Washington	3	6	9	10	44	322	12	0
Total Number of Moths	**163**	**65**	**63**	**52**	**146**	**936**	**129**	**54**
Total Number of Traps	**24**	**23**	**23**	**23**	**24**	**24**	**24**	**26**

* Intermittent cooperator operation ** Intermittent operation due to scheduling difficulty

Oystershell Scale (*Lepidosaphes ulmi*) - Pockets of beech with relatively high numbers of oystershell scale on the twigs and some yellowing of the foliage and twig/branch mortality were observed especially across central Maine in 1997. Low numbers of active scales were visible in many stands. Higher populations and damage were very spotty.

Pear Thrips (*Taeniothrips inconsequens*) - Low pear thrips populations were expected in 1997 so no monitoring surveys were planned. We were alerted early, however, by coworkers in Vermont of possible damaging populations. A hasty check of sugar maple at two locations (Mt. Vernon and N. Whitefield) on May 15th just past majority bud break yielded averages of .7, 1.8, 0, 3.5, 5 and 1 thrip per bud in six 10-bud samples. While not particularly high these figures were higher than expected. Most maple buds were nearly open at the time and visible damage in the sampled stands ranged from none to trace. Damage elsewhere across the state was similar.

Pigeon Horntail (*Tremex columba*) - This colorful wood wasp and its very large and striking parasites (***Megarhyssa* spp.**) continue to draw attention. The horntails infest sugar maple hosts and are followed by the large wasp parasites which are drawn to the woodboring larvae. The pigeon horntail continues to be primarily a problem in unsound wood on older and/or stressed trees. Reports of activity were again fairly common in 1997.

Pinkstriped Oakworm (*Anisota virginiensis*) - Numbers of this species remained very low in 1997.

Redhumped Oakworm (*Symmerista albifrons* and *S. canicosta*) - Both of these species occur in southern Maine and due to similarities between the two in all stages, our surveys have not separated them. Numbers of

larvae remained very low in 1997. The numbers of *Symmerista* spp. moths collected through our light trap surveys (Table 14) dropped in 1997 as well.

Saddled Prominent (*Heterocampa guttivitta*) - No larvae of this species or defoliation was observed in 1997. Moth catches also remained low (Table 15).

Table 15. Total number of saddled prominent (*Heterocampa guttivitta*) moths collected at light

	Year							
Location	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
Allagash	8	4	1	3	1	1	0	0
Arundel					0	0	0	0
Ashland	0	0	0	0	1	0	0	1
Bar Harbor*								0
Blue Hill	6	2	1	1	2	5	0	0
Brunswick	42	34	0	0	0	0	0	0
Calais	2	4	3	0	0	0	0	0
Chesuncook	51	10	12	13	10	37	18	13
Clayton Lake	4							
Dennistown	1	3	0	0	0	2	0	0
Elliotsville	6	5	4	4	0	0	3	0
Exeter	29	5	10	0	0	1	1	0
Greenbush	0	1	1	1	4	0	0	1
Guerette	0	1	0	0	1	0	0	0
Haynesville	0	0	0	1	1	1	0	0
Kingfield	0	0	1	0	2	0	1	0
Matagamon	7	0	1	0				
Millinocket	10	21	10	5	2	7	12	2
Mt. Vernon	21	32	19	1	1	13	6	2
No. Bridgton	0	41	15	9	2	0	0	0
Rangeley	0	10	4	0	0	1	2	0
Shin Pond					1	1	0	0
South Berwick	29	15	53	3	0	1	0	0
Ste. Aurelie	3	0	0	0	0	0	2	0
Ste. Pamphile*								0
Steuben	4	3	17	28	1	3	12	3
Topsfield**	7	5	11	4	0	7	0	0
Washington	3	50	23	1	0	0	0	0
Total Number of Moths	**233**	**246**	**186**	**74**	**29**	**80**	**57**	**22**
Total Number of Traps	**24**	**23**	**23**	**23**	**24**	**24**	**24**	**26**

* Intermittent cooperator operation ** Intermittent operation due to scheduling difficulty

Satin Moth (*Leucoma salicis*) - Populations of this species remained very low in 1997 and defoliation of woodland poplars was light and scattered. Moth catches also remained low (Table 16). Larval defoliation of individual white and Carolina poplar around homes and farmsteads, however, continued to be a problem.

Table 16. Total number of satin moth (*Leucoma salicis*) moths collected at light.

	Year							
Location	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
Allagash	3	3	2	2	0	0	2	0
Arundel					0	0	0	2
Ashland	5	0	7	3	5	1	0	0
Bar Harbor*								0
Blue Hill	0	0	0	0	9	2	0	0
Brunswick	2	0	0	2	0	0	0	1
Calais	6	5	0	0	3	2	0	2
Chesuncook	0	0	0	1	0	0	0	0
Clayton Lake	2							
Dennistown	2	3	1	5	1	0	0	0
Elliotsville	0	1	5	2	0	0	0	0
Exeter	0	0	0	0	0	0	0	0
Greenbush	1	2	0	0	1	1	1	3
Guerette	4	3	3	16	7	9	0	1
Haynesville	3	0	2	18	5	1	0	0
Kingfield	0	0	1	0	0	0	1	0
Matagamon	0	0	0	0				
Millinocket	1	5	17	3	4	0	1	0
Mt. Vernon	0	0	0	0	0	0	0	0
No. Bridgton	0	0	0	0	0	0	0	0
Rangeley	0	4	1	0	0	0	0	0
Shin Pond					14	0	4	2
South Berwick	0	0	1	1	0	0	0	0
Ste. Aurelie	0	0	0	0	0	0	0	0
Ste. Pamphile*								0
Steuben	41	22	2	2	8	5	0	1
Topsfield**	1	3	0	3	18	12	1	0
Washington	0	0	0	0	0	0	0	0
Total Number of Moths	**71**	**51**	**42**	**58**	**75**	**33**	**10**	**12**
Total Number of Traps	**24**	**23**	**23**	**23**	**24**	**24**	**24**	**26**

* Intermittent cooperator operation ** Intermittent operation due to scheduling difficulty

Sugar Maple Borer (*Glycobius speciosus*) - This species has not been much of a problem in Maine in recent years, however, like the **pigeon horntail** this status could change as the trees become older or stressed.

Tussocks (various) - Tussocks are fuzzy, variably-colored, caterpillars which often show up as defoliators of a variety of trees and shrubs. In most situations defoliation is light and the caterpillars are more of a curiosity. Occasionally, however, populations boom and defoliation becomes noticeable. The hairs of some species can *physically* cause skin irritation unlike those of browntail moth (not a tussock) which *chemically* cause a rash as well. "**Caterpillar rash**" or "**tussockosis**" is especially a problem during periods of hot weather. The **hickory tussock** (*Lophocampa caryae*), **rusty tussock** (*Orgyia antiqua*), **pale tussock** (*Halysidota tessellaris*) and the **spotted tussock** (*Lophocampa maculata*) have been the more common of the group in Maine. Although some such as the spotted and pale tussocks were locally abundant in 1997, their numbers and complaints of rash were relatively low overall. The **white-marked tussock** (p. 23) which was so abundant and caused heavy defoliation in 1997 in Nova Scotia occurred only as scattered individuals in Maine.

Variable Oakleaf Caterpillar (*Lochmaeus manteo*) - Populations of this insect continued low in 1997 and the only defoliation observed was very local and associated with the **gypsy moth** and **maple leafcutter**. Numbers of moths from the light trap survey rose slightly but not significantly in 1997 (Table 17). An evaluation of the impact of variable oakleaf caterpillar on beech stands that were heavily defoliated during the recent past outbreak compared to undamaged stands was continued in 1997. A preliminary evaluation of three years of data (1995-1997) did not show any significant differences between plots defoliated by variable oakleaf caterpillar compared to plots that were not defoliated. Study plots used for this comparison were established and measured using National Forest Health Monitoring Program methods and variables. See also Hardwood Decline (p. 50).

Table 17. Total number of variable oakleaf caterpillar *(Lochmaeus manteo)* moths collected at light

	Year							
Location	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
Allagash	0	1	1	0	0	0	0	0
Arundel					0	1	0	0
Ashland	7	10	6	0	1	14	0	0
Bar Harbor*								3
Blue Hill	7	4	5	0	9	30	9	0
Brunswick	4	2	0	0	0	3	0	0
Calais	2	4	3	0	0	3	0	0
Chesuncook	0	1	0	0	10	62	27	2
Clayton Lake	0							
Dennistown	7	7	0	0	0	5	0	0
Elliotsville	87	175	42	5	0	57	3	1
Exeter	9	7	0	0	0	6	4	3
Greenbush	49	39	3	0	7	11	4	14
Guerette	2	1	0	0	3	1	1	2
Haynesville	94	86	21	6	39	14	7	4
Kingfield	192	158	14	0	7	7	3	4
Matagamon	17	13	1	0				
Millinocket	169	310	122	85	148	185	18	86
Mt. Vernon	0	2	0	2	12	1	0	5
No. Bridgton	5	6	0	0	3	0	0	1
Rangeley	5	3	0	0	0	4	0	0
Shin Pond					2	15	4	20
South Berwick	11	15	3	8	0	4	0	0
Ste. Aurelie	0	0	0	2	1	0	0	0
Ste. Pamphile*								0
Steuben	3	3	0	0	2	3	0	2
Topsfield**	316	302	250	83	235	50	3	0
Washington	23	2	1	0	2	17	2	4
Total Number of Moths	**1,009**	**1,151**	**472**	**191**	**481**	**493**	**85**	**151**
Total Number of Traps	**24**	**23**	**23**	**23**	**24**	**24**	**24**	**26**

* Intermittent cooperator operation ** Intermittent operation due to scheduling difficulty

Willow Flea Weevil (*Rhynchaenus rufipes*) - This perennial pest again made its appearance in 1997 and caused the usual disturbance as adults dropped in on summer barbecues. The heaviest damage by adults and larvae was to black willow followed closely by weeping willow and balsam poplar. Trees defoliated year after year continue to survive with seemingly little permanent damage.

Miscellaneous INSECTS and other ARTHROPODS of Medical, Nuisance or Curiosity Significance in 1997

Ants (various) - There never seems to be a shortage of ants and 1997 was no exception. The **carpenter ants** (*Camponotus* spp.) were again the bane of homeowners as they threatened many domestic environments. Those pesky little mound forming lawn ants (several species) were also common and resisted many homeowner efforts at control.

For those who thought we might have true fire ants in Maine - we don't! But we do have a couple of species which are aggressive and pack a potent sting. Others may simply bite and inject formic acid into the wound producing a burning sensation. One of our more widespread stinging species is *Crematogaster lineolata* which often occurs in rough areas around gardens, in fields or the edge of woods. An introduced (from Europe) species, *Myrmica rubra*, inhabits coastal areas from Kittery to Eastport. This species is very aggressive and has a powerful sting and unfortunately appears to prefer nurseries and areas which have been landscaped. Highest populations seem to occur at Boothbay Harbor and on Mount Desert Island.

Ant flights involving the **cornfield ant** (*Lasius alienus*) were again reported in 1997 but were not as striking as in previous years.

Barklice or Psocids - (p. 25).

Banded Woollybear (*Pyrrharctia isabella*) Winter Weather Prediction Survey - Those familiar, fuzzy, red-banded, black caterpillars which children love to play with were very abundant in the fall of 1997. A series of popular articles on predicting winter weather from the width of the red or middle band (the wider the red band the milder the winter) prompted one reporter in Augusta to gather information for a local story. As a result, a number of our staff picked up a sample of the fuzzy creatures as they crossed roads in early October. Unfortunately many did not make it! (This calls for a "splat" survey - p. 52).

There are 13 segments or bands on each caterpillar and the total number by color (reddish and black) were tabulated. There were also commonly distinct half-bands (top half red, bottom half black) which were so recorded. Out of a total of 20 woolly bears the number of red bands ranged from 3 to 6.5. The average number was 4.73. As the normal is accepted as one-third red (4.33 bands), the width of the red band was wider than normal indicating a milder or less severe winter according to folklore. We'll see! It was fun anyway.

Boxelder Bug (*Boisea trivittata*) - The colorful red and black boxelder bugs were a nuisance as they wandered over homes in several York County locations in mid September. Although boxelder (*Acer negundo*) occurs statewide, to date this insect has only been reported as a problem in the Sanford (York County) area. In inland areas this species is often confused with the **small milkweed bug** (*Lygaeus kalmii*) adults of which have a similar appearance and habit of entering homes to hibernate.

Cockroaches (outdoor species - *Ectobius* spp.) - Just a reminder that Maine does have several species of cockroaches which live outside year round. These are not generally considered filth roaches although they can sometimes be confused with domestic species. The group of **forest roaches**, *Ectobius* spp., consists of possibly three introduced species. All occur in coastal areas or at most a few towns inland and are attracted to light at some times of the year. Species in this group somewhat resemble the **German cockroach** but *Ectobius* spp. roaches generally prefer to stay outside of buildings, fortunately!

Dogwood Sawflies (*Macremphytus* spp.) - Dogwood, especially gray and red osier, are often stripped of their foliage by the larvae of one or more of these sawflies and populations seemed to be high locally in 1997. The larvae are basically yellow with black spots at maturity but as they feed in the early stages they are

covered with a white, woolly wax. At maturity the larvae wander in search of a place to pupate and may bore into relatively soft wood (siding, decking, etc.) as much as one inch!

Euonymus Caterpillar (*Yponomeuta cagnagella*) - Defoliation was reported again in 1997 from a number of previously infested and remaining euonymus hedges and ornamental plantings but populations appeared to remain fairly stable at 1994 levels.

Fall Insects - As most homeowners prepared for the coming winter on warm fall days, many insects were doing the same. Some such as the **hunter's moths** (p. 31), **ants** and **woolly alder aphid** (p. 25) are primarily a curiosity or nuisance. Others such as the **paper wasps** (*Polistes fuscatus*) and yellow jackets (*Vespula* spp.) can produce a painful experience. Fertilized queen paper wasps will often seek out winter quarters within the home and they can sting! The biggest concern most people have usually involves the often massive numbers of insects such as the **cluster fly** (*Pollenia rudis*) **multicolored Asian lady beetle** (MCALB) and locally some of the true bugs. These can be a problem of longer duration and are often difficult to control. Most of these problems are perennial. The following were a few problems of special note in 1997:

Fungus gnats (Sciaridae) - On warm evenings in September and early October of 1997 we received widespread reports of "mosquito" activity from scattered locations across the state. Although a nuisance, most people noticed that these "mosquitoes" didn't bite! As it turned out these were not mosquitoes at all but fungus gnats which don't bite. Low numbers of fungus gnats are seen every year but numbers seen in the fall of 1997 were unusually high.

Multicolored Asian Lady Beetle (*Harmonia axyridis*) - These friendly but frustratingly pestiferous little beetles arrived pretty much on schedule with the warm fall weather. By October 7th, we had received numerous reports from across the state. Numbers were locally high in 1997.

True Bugs - While all insects are fondly referred to as "bugs" by the uninitiated, the term true bug refers only to sucking creatures in the Hemiptera. Throughout the summer months most species are afield, feeding and breeding. In the fall some such as the **squash bug** (*Anasa tristis*) and seed bugs such as the **boxelder bug** (p. 36), **small milkweed bug** (p. 36) and **western conifer seed bug** (p. 23) seek out homes to enter and spend the winter. The presence of these would-be tennants was locally a problem in 1997.

Japanese Beetle (*Popillia japonica*) - The sequence of reports of Japanese beetle activity were late and irregular in 1997. The first report was received from Bangor on June 29 followed by Portland on July 3rd and Auburn, Augusta, Gardiner and York on July 8th. Many populations had been heavily impacted by a parasitic fly (*Istocheta aldrichi*) in 1996 and were down in 1997. In other locations numbers in 1997 were at or above 1996 levels. The distribution of this pest continues to creep north and east.

Populations of the often associated but more widespread **rose chafer** (*Macrodactylus subspinosus*) remained relatively low in 1997. No new areas of infestation by the **oriental beetle** (*Anomala orientalis*) were reported in 1997.

Lily Leaf Beetle (*Liliocerus lilii*) - This introduced pest of true lilies (Liliaceae) has been found at several sites in York County. The striking red beetles with black head and legs and the slimy and ugly larvae were observed in the town of York on July 8th. Damage to lilies can be severe.

Medical Entomology - Maine state government does not have a designated medical entomologist position. As a result, MFS-I&DM staff receive requests for advice and assistance in dealing with an array of insect and other arthropod related problems. Included in these requests are questions relating directly to such things as **black flies, bot flies, deer flies, horse flies, bird mites, mosquitoes, no-see-ums, spiders, stinging insects** and **ticks**. Also included are insect vector related disease problems such as **eastern equine encephalitis, heartworm** and **lyme disease** and a series of **allergies, rashes** and **reactions**. The actual numbers of requests are not high but individual concern is often great. Disease questions *per se* are referred to medical professionals.

Biting Flies (various) - Although the relatively wet spring led many to expect high numbers of our summer biters, we were generally pleasantly surprised. As the season dried out the usual **black fly** and mosquito seasons came and went with only minor inconvenience except in more stubborn areas. Coastal areas were the primary exception and there, **salt marsh mosquitoes** and the infamous **salt marsh greenhead fly** (*Tabanus nigrovittatus*) took their toll. Of those which need blood, the **horse fly/deer fly** group predominated inland where numbers were active through August. **No-see-um** populations were not as high or of as long duration in 1997 as in 1996.

Stinging insect populations in Maine were lower than usual again in 1997 at least in southern Maine. The most notable reductions again involved populations of **bumble bees**, **honey bees** and **yellow jackets**. Some **ground nesting solitary bees** and **paper wasps** (*Polistes*) seemed to fare better. Several colonies of a very attractive and interesting greenish, fuzzy, **ground nesting bee** (*Agapostemon* sp.) were again reported from southern Maine in 1997. While a lot of concern was expressed by fruit and vegetable growers about noticeable reduction in pollinators, campers and picnickers welcomed the reduction in yellow jacket populations.

Rashes related to insects was again of concern in 1997 in response to activities of the **browntail moth** (p. 26) in the Casco Bay area (Cumberland County) and to populations of **tussocks** (p. 35) elsewhere.

Spiders were not as much of a source of concern in 1997 as they were in 1996.

Ticks (Ixodidae) - The number of ticks received in 1997 (204) dropped from 1996 (292) levels but continued to involve relatively high numbers of the **lyme** or **deer tick** (*Ixodes scapularis* = *Ixodes dammini*). Numbers of the **American dog tick** (*Dermacentor variabilis*) were still high but clients appear to be more sure of the identification of this species and tend to report it less frequently. Populations of both of these species continued to spread slowly north and east. Larvae of the **moose** or **winter tick** (*Dermacentor albipictus*) were still common in November and December in some areas. Roughly thirteen species of ixodid ticks occur in Maine but the highest numbers and greatest diversity occur in southern Maine (Fig. 9).

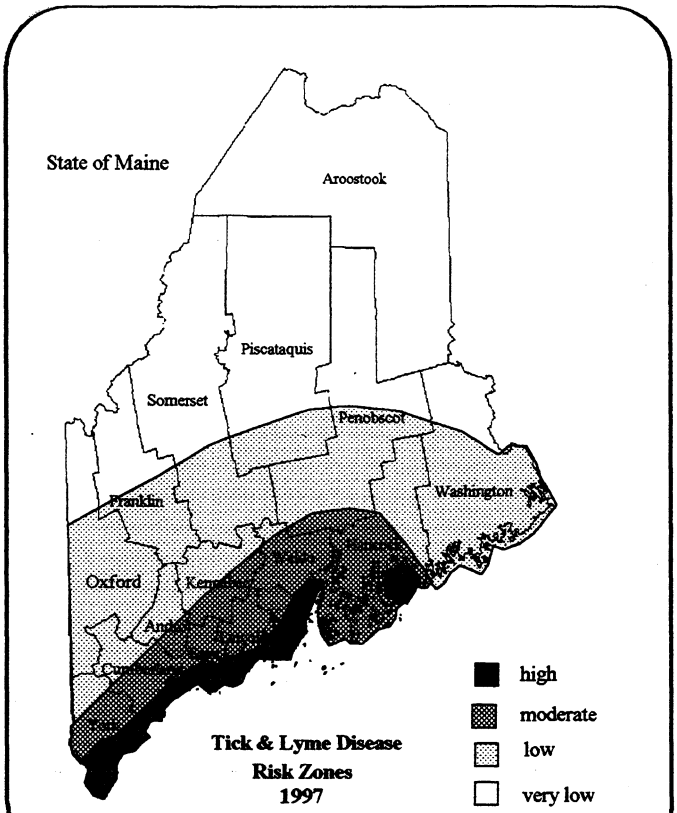

Figure 9

Lyme disease in Maine - It is still somewhat difficult to define the nature of this problem in Maine due to confusing qualifying criteria and data gathering problems. Suffice it to say that the incidence of lyme disease remains relatively low in Maine and is highest primarily in coastal areas. Only 25 cases were reported to the Maine Bureau of Health in 1997, and of these only 14 were Maine acquired which is down noticeably from 1996. Only 137 cases of Maine acquired lyme disease have been reported since monitoring for this disease began in 1986. Two new counties were added to the list of endemic counties in 1997 based on the diagnosis of infected ticks from a single town in each county, Somerset (Palmyra) and Washington (Lubec). The Maine Lyme

Disease Task Force has prepared a map (Fig. 10) to present the current status of the disease in Maine. Please note that any records for a county characterize the entire county as endemic (i.e. the records for Penobscot County are all from the Old Town area thus in reality only southern Penobscot County is endemic). It is also almost certain that Waldo County should also be considered endemic.

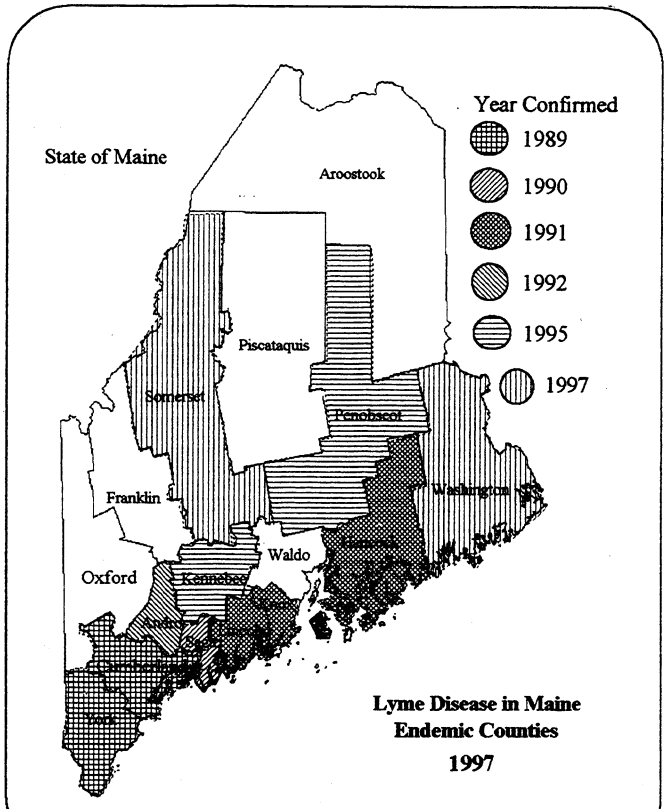

Figure 10

Potato Leafhopper (*Empoasca fabae*) - This basically agricultural pest has a very broad host range which includes flower garden plants as well as some deciduous trees and shrubs. The potato leafhopper overwinters in the Gulf States but when conditions are right, as they were this past season, large numbers move north with the prevailing frontal systems. Gnarled, stunted and often yellow foliage was reported on many garden plants (especially beans and potatoes) as well as dahlias, birch, little-leaf linden and locust in 1997. This species has been rare on trees in Maine in the past.

Public Assistance -The I&DM staff handled well over 3,000 different requests for advice and assistance in addition to specific surveys and project work in 1997 (Tables 18 and 19). Tables 20, 21, 22 and 23 give a breakdown of many of the problems handled by Augusta I&DM staff in 1997 showing some of the diversity of requests.

Table 18. Total number of requests for advice and assistance, 1997

Problem	Total Requests
Forest, Shade and Ornamental Tree	2,018
Forestry Related Quarantines	566
Human Health Related Pests	486
Household, Nuisance and Miscellaneous	288
Total	**3,358**

Table 19. Percent requests for technical advice received in 1997 by user community

User Community	% Requests
Arborists, Landscapers, Garden Centers	2.5
Consulting Foresters	2.2
DOC Bureaus	2.5
Environmental Associations, Clubs	1.4
Forest Industries (land managers and foresters of paper companies)	22.3
Forest Nurseries	0.7
General Public (landowners, shade tree owners)	50.8
Government Agencies (federal, state, municipal)	7
Law firms	0.1
Medical Profession (doctors, nurses, health officers)	0.6
News Media	1.6
Pest Control Operators and Consultants	0.9
Plantation Owners	4.8
Schools	0.2
Universities	2.4
Total	**100**

Table 20. Number of requests received in 1997 for advice and assistance about forestry related quarantines

PROBLEM	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Compliance agreements	16	2	0	1	2	0	0	0	0	0	1	1	23
ELC requests	1	2	0	0	0	0	0	1	3	0	1	0	8
Gypsy moth permits	60	36	23	29	28	53	42	44	53	38	35	39	480
Other gypsy moth requests	0	0	0	1	0	0	1	1	2	1	1	0	7
HWA requests	16	9	1	0	0	0	0	0	0	0	0	0	26
Ribes	0	0	0	0	0	0	0	0	0	3	2	5	10
Other requests	0	0	0	0	5	1	3	0	0	0	1	2	12
TOTAL	**77**	**47**	**24**	**30**	**35**	**54**	**46**	**46**	**58**	**42**	**40**	**47**	**566**

Table 21. Number of requests received in 1997 for advice and assistance about pests causing human health problems

PROBLEM	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Browntail moth	48	35	18	13	32	54	21	9	8	8	4	9	259
Ticks *	0	0	3	14	37	37	35	16	12	4	8	0	166
Mosquitoes	0	0	1	1	6	4	2	0	0	0	1	0	15
Human health pests	1	0	1	1	1	0	0	1	4	1	6	1	17
Biting flies	0	1	1	2	6	0	2	2	3	0	0	0	17
Blackflies	0	0	0	1	4	7	0	0	0	0	0	0	12
TOTAL	**49**	**36**	**24**	**32**	**86**	**102**	**60**	**28**	**27**	**13**	**19**	**10**	**486**

* This figure does not reflect the total number of ticks identified for the Bur. of Publ. Health

Table 22. Number of requests received in 1997 for advice and assistance about household pests, public nuisance pests, and miscellaneous pests

PROBLEM	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Ants		2	2		9	1	7	3	6		1	1	32
Asian lady beetle	2	2	1	1						21	2	7	36
Bees							1		1				2
Bird mites		1			1		2			1		2	7
Booklice													0
Carpenter ants		2	3	2	8	9	10	5	1			2	42
Clothes moths													0
Cluster flies						1	1				1		3
Cockroaches		3		1		1	1						6
Crickets													0
Dermestid beetles		1	1		2	2	2						8
Earwigs						3		2					5
Firewood insects	2	1		1					1	2	3		10
Fleas									1	1			2
Flies						2	1	1		2	1	1	8
Fruit flies										1			1
Fungus gnats							1			1	2	2	6
Hornets and wasps					1		2	2	4	1			10
House flies													0
Indian meal moth	2			1	2	1	2	1		1			10
Ladybird beetles	2		1	2	5								10
Midges													0
Misc. insects	2	5	6		2	1	2	1	2	1	2		24
Misc. non-insects			3		3	4	5		1	1		1	18
Pantry pests			5	1		1	3	2		3	1	1	17
Powder post beetles								1				1	2
Spiders			2			3	5	1	2	1	2	1	17
Springtails	3	3	4		1		1						12
TOTAL	**13**	**20**	**28**	**9**	**34**	**29**	**46**	**19**	**19**	**37**	**15**	**19**	**288**

Table 23. Number of requests received in 1997 for advice and assistance about forest, shade tree, and ornamental pests

PROBLEM	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Abiotic factors	6	6	3	8	10	8	16	22	10	5	6	5	105
Animal damage	1	2	2	2		7	2	1	1			2	20
Anthracnose			1				3						4
Arborvitae leafminers			1		3	7		2				4	17
Asian long horned beetle											1		1
Adelgid galls on spruce			2		7	3	3		1				16
Annosus root rot			1					1	1				3
Aphids			1		3	3		1	5	2			15
Apple scab disease						1							1
Ash decline	2	1	2			3	1	1		4	2	5	21
Balsam needle gall midge										2			2
Balsam twig aphid	8	4	5	14	23	15	5	2	2	6	9	6	99
Balsam woolly aphid			2	2	1	1	1				1		8
Bark beetles		3			4	6	4	9	3			2	31
Beech bark disease	1		1				3	1		1	1	1	9
Birch leafminers					1		5						6
Black knot of cherry				1		2	2			2			7
Bronze birch borer					1			3	2	2			8
Brown ash decline				1		1							2
Butternut canker		1	3										4
Cankers						1	1	1	1				4
Chestnut blight fungus				1		1							2
Dogwood anthracnose	1	1											2
Dutch elm disease	1	1					4						6
Eastern dwarf mistletoe	3	2	1	2	9	4	10	30	13	6	6	13	99
European larch canker					1				1				2
Fall webworm								7	4	1			12
Fir-fern rust						3	1	1					5
Galls on deciduous trees					1	4	1	1					7
Gypsy moth	11	8	2		1	2	4	23	19	7			77
Hemlock borer		2	2	1	2	1		2	5	6	1	1	23
Hemlock looper	1	1	2	1	2	1		1	2		2		13
Hemlock woolly adelgid		1		3		2	1		1	1			9
Herbicide				2	2	1	2	2	4	2	1		16
Japanese beetles						1		4					5
Larch casebearer					8	2							10
Leaf beetles						3	1		3				7
Mites					3	2	2	1	1	2		3	14
Mountain ash sawfly							1						1
Oak twig pruner								2	2				4
Roundheaded appletree					4				1	1	1		7
Rusts						3							3
Sapsucker injury					1								1
Salt injury		6	1		3								10
Satin moth						5							5
Sawflies	1					1	2	5	38	2			49
Sawyer beetles						2		1	1				4
Scale insects						1		1	1		2	4	9
Spittlebugs					2	5							7
Spruce beetle	18	16	9	11	22	12	37	37	9	5	9	4	189
Spruce budworm	4	6	9	12	1		3	3	10	1	2	3	54
Spruce gall adelgids					1	1	1						3
Spruce health	3	3	2	3	8	3	9	7	3	3	4	2	50
Variable oakleaf caterpillar								4	4				8
White pine blister rust	4	2	3	14	32	41	32	36	31	20	13	2	230
White pine weevil	3	4	7	3	1	12	4	8	4	1	1		48
Woodborers	3	2	1	1	1	2	3	3	1	6	1	1	25
Yellowheaded spruce sawfly	12	16	15		10	29	26	20	7	3	6	2	146
Other requests	17	25	31	25	42	73	64	61	58	44	13	20	473
TOTAL	**100**	**113**	**109**	**107**	**210**	**275**	**254**	**304**	**249**	**135**	**82**	**80**	**2,018**

DISEASES and INJURIES Associated With Trees in 1997

Acid Rain (caused by certain pollutants entering the atmosphere and reacting to form sulfuric and nitric acids) - This subject has received much play in the popular media over the years but most reports of damage are unfounded and easily attributable to other causes. But the perception persists that acid rain is significantly destructive to forest vegetation. Each year we receive calls expressing concern about the effect of acid rain on Maine forests.

Most recent research has concluded there is no evidence of general, widespread decline of forest species due to acidic deposition, though there may be local effects due to acid fog at certain coastal or high elevation sites in the northeast. There may also be subtle effects of acid deposition such as increased nutrient leaching from plants and soils which may negatively impact tree growth or winter hardiness. And there is the possibility that effects of acidic precipitation may increase the susceptibility of trees and other plants to certain diseases. Studies are ongoing to elucidate these possible effects.

When acid rain first commanded national attention in the 1970's and 80's, it was common for weather forecasters to announce the acidity of precipitation events as part of local weather broadcasts. This practice has now largely ceased, but we recently asked our state Department of Environmental Protection about trends in acid precipitation in recent years. We were interested to note there were no trends. The mean pH of precipitation statewide has held steady at about 4.6 since 1982.

Annosus Root Rot (caused by *Heterobasidion annosum* syn. *Fomes annosus*) - Every year we seem to confirm the presence of annosus root rot at one or more previously unreported sites. Last year was no exception. An infected red pine plantation in Madison was brought to our attention by a concerned forester. Disease was developing as "fomes holes" in a plantation which had been thinned once without stump treatments.

This is primarily a disease of plantation pine in Maine. To date we have recorded infected plantations in the following counties: Androscoggin, Cumberland, Franklin, Kennebec, Lincoln, Oxford, Penobscot, Piscataquis, Sagadahoc, Somerset, Waldo, and York (Fig. 11).

When harvesting pines in red pine plantations, it is important to treat stumps with borax immediately following tree harvest. *Heterobasidion annosum* is a pioneer organism that colonizes only freshly cut stumps, and borax must be present on the stump before the organism has a chance to invade.

We recommend borax treatment of freshly cut stumps at all times of year, but clearly infection hazard is greatest in the fall when spores of the causal organism are being abundantly released.

Also last year we revisited an older red pine plantation in Parsonsfield which had been thinned several times without stump treatment. Disease was rampant, and even

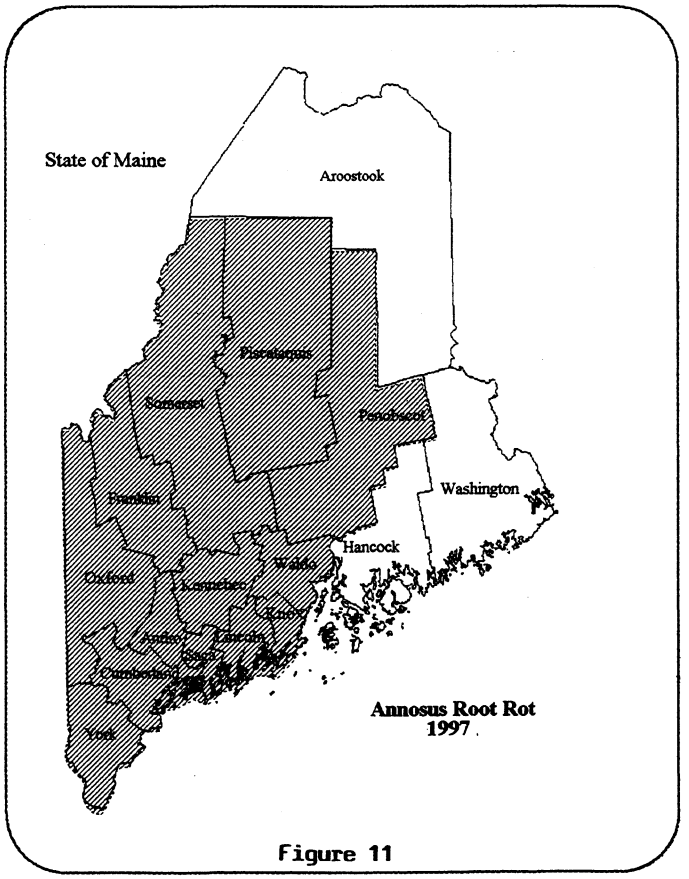

Figure 11

natural seedling regeneration of white pine showed evidence of limited *Heterobasidion* infection. But much of the white pine reproduction looked healthy, and was not impacted by white pine weevil due to the shade provided by taller overstory, often infected red pines. Clearly white pine was going to comprise the next forest on this site. We did note a bit of white pine blister rust among the white pine reproduction, and subsequently conducted a *Ribes* eradication program on that site to check the advance of that disease.

Ash Leaf and Twig Rust (caused by *Puccinia sparganiodes*) - This disease was last epiphytotic in Maine from 1982-1984. The moderate outbreak of this disease which began in 1995 in the Stockton Springs/Frankfort/Winterport areas of midcoast Maine has continued each year since but has not enlarged significantly. Elsewhere along the coast, we have noted trace infection of white ash but no significant outbreaks of this disease.

We now feel the trend for this disease is static, but if weather conditions are favorable for infection next June, this disease could possibly be significant in coastal areas of Maine in 1998.

Ash leaf and twig rust is a spectacular disease when it occurs in epiphytotic situations, often totally defoliating trees. It only occasionally kills trees, but may weaken them so that they succumb to other causes, especially where the disease strikes heavily in successive years.

Ash, Maple, and Oak Anthracnoses (caused by *Apiognomonia errabunda, Kabatiella apocrypta,* and *Discula quercina* respectively) - These diseases, which cause irregular tan or brown spots or blotches on leaves often followed by defoliation, were less prevalent last season than normal, perhaps the result of dry weather during bud break. We received a few specimens of maple anthracnose, but almost no inquiries regarding ash anthracnose.

Ash Yellows (caused by a mycoplasmalike organism) - Ash yellows apparently does not occur in Maine. Recent surveys for this disease conducted by the University of Maine have proved negative.

Atropellis Canker (caused by *Atropellis tingens*) - Atropellis canker is a relatively uncommon fungal disease of pines in Maine which is occasionally a problem in Scotch pine plantations and natural stands of pitch pine, particularly in the southwestern part of the state. This disease is characterized by sunken, perennial cankers on twigs, stems and branches. Wood beneath cankers is darkly stained bluish black in color. The bluish black stain often appears wedge-shaped when branches are cut and cankers are viewed in cross-section. Affected branches flag and needles turn brown in spring and early summer.

We received no new reports of this disease in 1997. The disease is potentially damaging to pines in Christmas tree plantations but usually is not much of a problem in Maine where relatively few pine species are now grown for Christmas trees. Where pines are planted, *Atropellis*-free planting stock is generally used and plantations are rarely established near infected natural stands, so chances for infection are low.

Balsam Fir Tip Blight (caused by *Delphinella balsameae* syn. *Rehmiellopsis balsameae*) - This disease, which is commonly severe only in plantations of Colorado white fir (*Abies concolor*), was quite conspicuous in portions of a natural stand of balsam fir in T30MD last August. Current year fir shoots on many branches had collapsed and were dangling from branch tips over an area of several acres. Most infected trees were approximately ten to thirty feet in height, and growing in the open. In the most severely affected areas, essentially every tree was symptomatic, with the majority of shoots collapsed and dangling.

Black Knot of Cherry (caused by *Apiosporina morbosa*) - This disease is common in forest situations throughout the state on wild cherry trees and is particularly conspicuous on black cherry where galls a foot or more in diameter may occur. Where these galls occur on the main stem the value of cherry for lumber is considerably reduced. Damage often extends internally well beyond the galled area, because the gall canker serves as an entry point for wood decay organisms which spread internally over time.

Frequently we receive reports of black knot infections on cultivated peach, cherry or plum trees in landscape or home orchard situations. All too often by the time we are consulted the disease has progressed to such an extent that the usual control practice of pruning knotted twigs and branches to remove infected tissue would essentially reduce the tree to a stump. It is important to diagnose this disease early, prune any knotted twigs each year before April 1, and spray if necessary with the fungicide thiophanate methyl in order to maintain healthy, productive fruit trees.

Boxelder Canker (caused by ? *Fusarium lateritium*) - This disease, which was very noticeable in 1991, 1993, and 1995 was severe again in 1997. Perhaps coincidentally, this disease seems to be worse in alternate years.

Crowns of affected trees were flagged with branches bearing dead leaves by late June. Small stem cankers were present on infected new growth while larger, perennial cankers occupied larger branches. While this disease apparently causes no mortality, it is capable of transforming a tree of limited value into an outright liability in the landscape.

Brown Ash Decline (caused by environmental stresses) - The recovery of black ash, *Fraxinus nigra*, (called brown ash in Maine) from a state of serious decline continued in 1997. The statewide decline first became apparent in Maine in 1992 and was studied and evaluated on 57 plots established in four geographical zones throughout Maine in 1993 (MFS Tech. report #33). In 1995, remeasurement of 31 of the original plots showed that apparently the decline had subsided and brown ash condition was improving (Tech. report #37). Meanwhile, studies at the University of Maine had shown significant correlations between reduced brown ash growth and high water and freezing events in the early winter followed by spring drought conditions. Studies by the MFS and USFS - FHP in the 90's had not shown any significant relationships between insect or disease agents and the decline.

In 1997, as in 1996, brown ash tree condition was evaluated through a reassessment of 12 (three plots in each of the original zones) of the original 57 brown ash dieback plots established in Maine in 1993. National Forest Health Monitoring Program (NFHM) crown variables and variables described specifically for the brown ash plots were used to assess tree condition. Data analysis from this plot subset in 1996 revealed that the decline had ceased and that most trees were showing significant recovery. This trend toward recovery continued in 1997 (Table 24). Mean dieback for the 12 remeasured plots was 3.7 % in 1997 compared to 48.4 % in 1993 and 7.4 % in 1996. Current mean dieback in the 12 brown ash plots evaluated in 1997 is considered normal for a hardwood species in good condition. Leaf size and color and crown structure were also improved in 1997 resulting an increase in the crown density (improvement) in most plots.

The same factors resulted in a decrease (improvement) in crown transparency. As in 1996, a small amount of additional tree mortality was observed (3% in 1996 and 1.6% in 1997). Brown ash tree mortality in 1996 occurred primarily on trees classified as moribund in 1995, however, most of the 1996 tree mortality was thought to be unrelated to the earlier decline.

Barring a recurrence of conditions that caused the original decline, brown ash condition is expected to remain good in 1998.

Table 24. Brown Ash Decline and Recovery in Maine

Changes in NFHM Variables from 1993 to 1997			
YEAR	DENSITY	DIEBACK	TRANSPARENCY
1993	26.7	48.4	16.7
1995	31.8	13.4	20.0
1996	42.4	7.4	16.2
1997	45.7	3.7	15.3

Bud Abortion of Balsam and Fraser Fir (caused by low ambient air temperatures prior to budbreak) - This symptom was relatively uncommon during the spring of 1997 due to relatively mild temperatures throughout the period of bud expansion prior to budbreak. In fact, this problem has not been severe in Maine since 1987 and 1988. We continue to make note of it here because when it occurs it can be a significant problem, causing "holes" in Christmas trees and the production of unusually vigorous, twisting shoots which arise from the relatively few remaining unaborted buds on affected trees.

Butternut Canker (caused by *Sirococcus clavigignenti-juglandacearum*) - Butternut canker, a disease which has virtually eliminated butternut in the Carolinas, was first found in Maine in 1993 when we located the disease in Kennebec County. We continued to survey for this disease in succeeding years, and have now located it in all Maine counties except Washington County (Fig. 12).

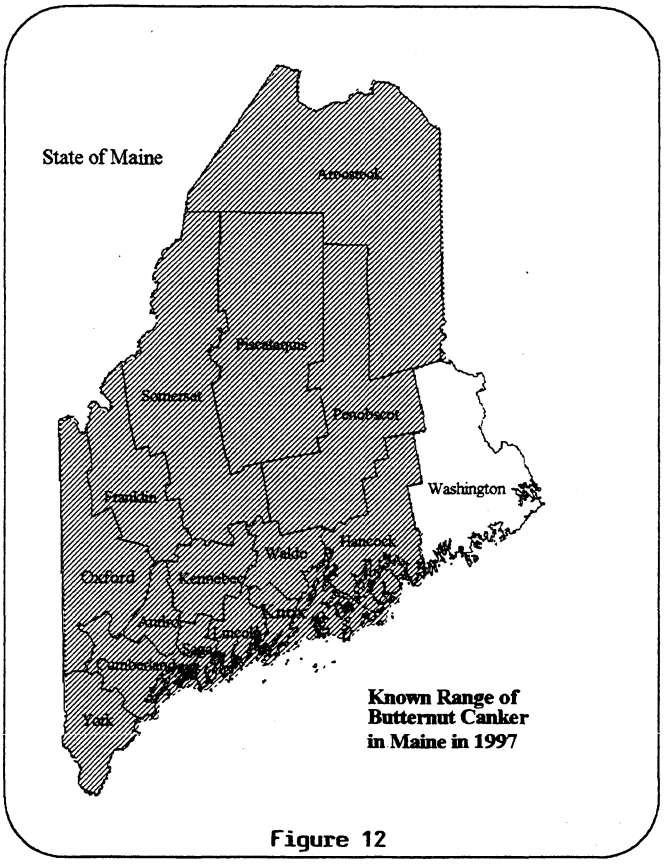

Figure 12

Butternut canker is characterized by dying branches and dead tops, development of epicormic branches, discolored bark which may ooze a thin black inky fluid in the spring, and cankers on the main stem, buttress roots, and branches. When bark in cankered areas is physically stripped away, the sapwood beneath exhibits dark brown, spindle-shaped, stained areas.

No effective controls are available to halt the spread of this disease at this time. Logging injuries should be minimized when harvesting. In nurseries, and perhaps in some homeowner situations, application of fungicides may be appropriate. In some states, butternut harvesting guidelines and even harvesting moratoriums are now in effect. There is considerable evidence that resistant individual butternut trees exist within the native population and researchers are now beginning to develop strategies to exploit that resistance to protect the species.

The upward trend of this disease is expected to continue into the foreseeable future.

Caliciopsis Canker (caused by *Caliciopsis pinea*) - This is a generally minor, but occasionally important disease of eastern white pine which is often overlooked. Though we have known about this disease for many years, we are only now becoming aware of its significance and widespread occurrence in Maine. Every year we receive a few inquiries about cankered trees in stagnated white pine stands, and frequently we diagnose Caliciopsis canker as the cause.

Cankers may occur anywhere on tree trunks or suppressed branches and usually occur only in small numbers on a single tree. However, severely attacked trees may contain as many as several hundred cankers. Cankers may be superficial or they may extend into the cambium, killing it.

This is primarily a disease of stagnated stands or suppressed trees in dense stands. It may be effectively managed through judicious and timely stand thinnings.

Chemical Injury (phytotoxicity due to chemical pesticide application) - We received many reports of chemical injury to trees and shrubs in 1997. Growers and landscape managers should be especially alert to the possible phytotoxic effects of certain pesticides when applied to tender, emerging plant foliage. Certain evergreens are quite susceptible, especially when applications involve emulsifiable concentrates, mist blower applications, and/or treatment during hot weather. We have repeatedly warned balsam fir Christmas tree growers to be careful of Diazinon AG 500 and Lorsban 4 E when applying them during late May and early June.

Causes of chemical pesticide injury are many and varied. Among the calls we investigated in 1997 were herbicide injury problems involving Roundup application to improperly hardened Christmas tree foliage, lawn herbicide application being picked up by the roots of desirable ornamentals, and agricultural herbicide application (Clomazone) drifting (carried as vapors) to nearby home landscapes. In the latter case symptom expression on nearby trees, shrubs, and gardens was spectacular.

We also received some false reports of herbicide injury during 1997. A common call involved gardens browning and drying up near roadsides, especially where potatoes were being grown. Anxious homeowners were quick to blame the Maine Department of Transportation for improper roadside herbicide use, but the problem was invariably potato leafhoppers (p. 39), which descended upon Maine last season in unusual numbers, quickly browning the foliage of certain crops.

Chestnut Blight (caused by *Cryphonectria parasitica*) - This disease, which was introduced to North America around 1900 on nursery stock of oriental chestnuts, subsequently spread into Maine and quickly destroyed our native American chestnut resource. A few infected trees persist, often sprouting from old stumps, and occasionally a seedling will grow to considerable size in the woods before succumbing to the disease. American chestnut trees planted as landscape specimens also frequently attain considerable size before fatal infections develop.

Recently considerable interest has been expressed in support of an effort to reintroduce the American chestnut into Maine forests. The expectation is that resistant trees may be available for distribution within a few years.

Cone Buds - Balsam fir Christmas trees in some plantations set significant numbers of cone buds during the summer of 1997. This means that 1998 will likely be a cone year, with all the problems that brings for Christmas tree growers. Plantations of Cook strain trees, or those of similar types (bluish color with "double" foliage), are particularly susceptible to this problem.

One might think that cones would only add to a tree's ornamental value. But as fir Christmas tree growers are well aware, fir cones mature and disintegrate prior to harvest leaving behind unsightly "spikes." Worse, where cones are produced, green shoots are not produced, which results in unsightly "holes" near the tops of trees after the cones disintegrate. Also, when cone set is very heavy, tops of trees turn yellow, rendering affected trees unsaleable.

Growers who need seed will probably have an opportunity to collect it in quantity in 1998. But growers may want to resist the temptation to collect seed from even the better looking trees in their plantations. Those trees will be "early coners" (trees which tend to produce cones at a young age) and, to the extent this trait is heritable, resulting progeny are likely to form cones early as well. Growers are advised to collect seed from good trees in the wild, or ideally from seed orchards where trees form cones at a young age due to grafting rather than any genetic predisposition to early flowering.

Cristulariella Leaf Spot (caused by *Cristulariella* spp.) - This disease, which caused extensive leaf spotting and defoliation especially of boxelder in south central Maine in 1990, has since all but disappeared. Apparently the weather conditions which favor this disease, consecutive hot, summer days and nights with high dew points, have not recurred in Maine since that time.

Drought Damage to White Pine (caused by a precipitation deficit during the 1995 growing season) - White pine trees in many central and southern Maine counties are now exhibiting foliage browning symptoms ranging from flagging of occasional branch tips to the death of complete branches in the lower crowns, and occasional mortality of scattered or grouped trees. Close examination reveals a myriad of organisms at work attacking affected trees, none of which by itself appearing capable of causing the extensive damage observed.

Among the organisms present on affected trees are the *Septobasidium pinicola/Matsucoccus macrocicatrices* complex which is frequently very abundant on smaller branches, species of *Pityopthorus* and *Pityogenes* beetles, *Trisetacus alborum* fascicle mites, plus an unidentified canker organism which causes abundant pitching on occasional boles high in trees but does not appear to be unusually virulent and is frequently overgrown by healthy tissue. Also present is occasional white pine blister rust and armillaria root rot infection and mechanical damage. The damage is widespread, particularly in York, Cumberland, and Kennebec counties, and is worse on certain sites. None of the aforementioned insect or disease problems is uniformly associated with affected trees in all stands.

Damage is more severe on sites where soil conditions are conducive to drought stress, especially those soils which are either excessively well-drained or so poorly drained that rooting depth is restricted.

While root systems of affected trees generally appear healthy, growth rings laid down in 1995 are much reduced in size, yet 1996 growth rings were of normal size. Following drought in 1995, abundant rains were common over much of southern Maine in 1996, and we feel that explains the growth ring variation observed. Growth rings for 1997 are also much reduced in size in affected trees, but that may have been the result of reduced photosynthesis in declining trees. We looked at shoot growth of affected trees to see if it was correlated to reduced ring growth in 1995 and found that it was not. In fact, shoot growth was greater in 1995 than 1996, an inverse relationship to ring growth. We theorize that shoot growth was of normal length in 1995 because growth expanded prior to the onset of severe drought conditions, but as the drought deepened, bud set which provided the basis for subsequent year growth (1996) was adversely affected resulting in reduced shoot length that year. This is consistent with a drought theory for white pine decline.

The summer of 1997 also provided a shortfall of beneficial precipitation which may have further stressed affected trees. And late into the fall and winter of 1997, we continued to note scattered trees, particularly suppressed and subdominant trees, continuing to lose color and die in affected stands.

We expect mortality of individual white pine trees on drought stressed sites to continue into 1998 and perhaps beyond.

Dutch Elm Disease (caused by *Ophiostoma ulmi* and *Ophiostoma novo-ulmi*) - Symptoms of Dutch elm disease (DED) were quite conspicuous throughout Maine during 1997 and generated numerous inquiries of our staff.

Many old elms which escaped the initial wave of infection now succumb each year, at least partially the result of the development of more aggressive strains of the disease organism. While protecting these older specimens is the concern of most of our clients, we occasionally receive calls regarding mortality of younger elm trees (4-8" dbh and 20-30 feet tall). Such trees are frequently numerous in old field areas, the progeny of susceptible old elms now long gone. The progeny are, of course, also susceptible to Dutch elm disease and, due to their high numbers and density, are extremely vulnerable to mini-epiphytotics (epidemics). Increasingly we are asked to comment on the suitability of 'American Liberty' elms for planting in Maine. Residents of many communities long to restore the elm-canopied streets they remember from their youth or have viewed in historical photographs. They wonder if the extensive

planting of DED resistant 'American Liberty' elms is an appropriate means to restore yesterday's urban landscapes.

We don't think so, for several reasons, but would not discourage limited elm plantings in selected areas.

The 'American Liberty' elm is not one clone but a group of six selections. Collectively they exhibit some resistance to DED but are not immune. Almost certainly some of those six selections are more resistant than others, but to line city streets with elms that are only partially resistant to DED is a risky proposition at best. And while 'American Liberty' elms are perhaps the best known and most available of the resistant sorts, they are not necessarily the most resistant.

Two resistant cultivars recently released by the U.S. National Arboretum, 'New Harmony' and 'Valley Forge,' are attracting considerable attention but are not yet available for retail sale. Of these 'Valley Forge' may be the more resistant but 'New Harmony' may be more cold tolerant, an important consideration for Maine. Another resistant cultivar is said to be close to release by the U.S. National Arboretum.

We would encourage limited plantings of resistant cultivars in areas where trees could be easily removed if they become diseased such as in park areas away from utility lines and structures. But we don't feel that the development of resistant cultivars has reached the point where large scale elm restoration along city streets is yet appropriate.

Eastern Dwarf Mistletoe (caused by *Arceuthobium pusillum*) - Severe damage as the result of infection by this parasitic plant continues to occur in stands of white spruce in coastal areas of Maine. Evidence of significant mistletoe infestation was noted in 1997 on coastal headlands and islands from Machias in the east to the Boothbay region in the west. Trees of landscape value succumb each year in the yards of coastal residences as this organism gradually drains trees of their vigor. Removal of witches' brooms (infected portions of branches), together with appropriate fertilization, generally helps to maintain the vigor of affected landscape trees. But such measures are impractical in woodland areas, and several islands in Friendship and Port Clyde have recently been extensively harvested in response to mistletoe damage.

Dwarf mistletoe also frequently occurs on black spruce, particularly in inland bogs, and on red spruce in many forest situations. Brooms on red spruce are often more poorly developed than on white or black spruce and may be overlooked. However infected residual trees left during timber harvesting activity can result in the infection of spruce regeneration. Infected trees should therefore be identified if possible and removed during the harvesting operation, and harvested areas revisited every ten years or so to remove any symptomatic trees missed during the initial harvest.

Dwarf mistletoe was encountered on several coastal islands this past summer during the course of spruce beetle surveys (p. 20), among them Isle Au Haut, Islesboro, Deer Isle, Loud's, Eagle and Monhegan Islands. Most islands off the Knox and Lincoln County coast where spruce is a significant cover type are infested with mistletoe to some degree. As on the mainland, damage is more severe on white than red spruce, with the most significant mortality occurring in areas immediately adjacent to the open ocean.

The trend for this disease is upward.

An informational alert has been prepared describing this problem in Maine.

European Larch Canker (caused by *Lachnellula willkommii*) - European larch canker is a fungal disease which originated in Europe and was first found on native larch (tamarack) in southeastern Maine in 1981. Information gathered from existing cankers indicates this disease has been present in Maine since at least the 1960's and perhaps much longer. This disease may infect any species of the genus *Larix* or *Pseudolarix*. Since larch canker has the potential for causing serious damage to both native larch stands

and reforestation projects utilizing non-native larches in Maine and elsewhere, the disease is under state and federal quarantine.

Each year we survey one or more towns close or adjacent to known infested areas (Fig. 13) to check for evidence of disease spread.

MFS surveys in 1997 of previously uninfested areas proved negative. Commercial larch seed orchards in the towns of Unity and Howland were also checked for evidence of larch canker; no disease was found.

The trend for this disease is static.

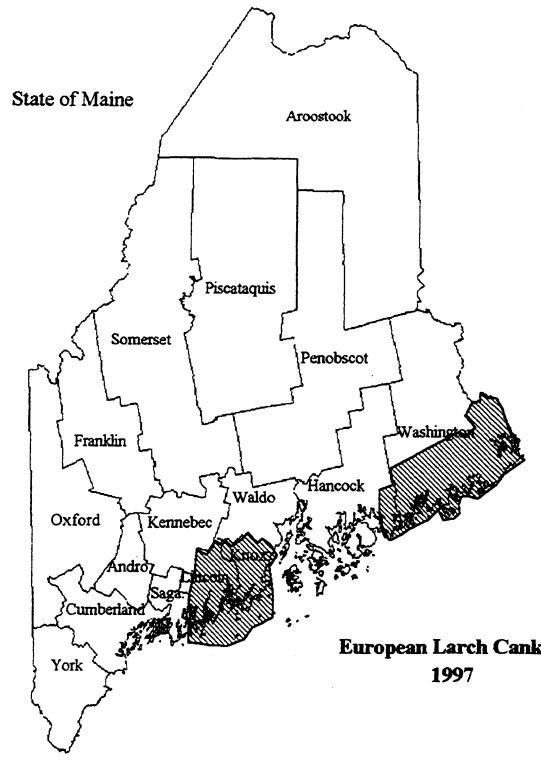

Figure 13

Fertilizer Damage (caused by inappropriate use, placement, or quantities of chemical fertilizer) - Every year we receive reports of trees showing symptoms of various types of fertilizer burn. Often the problem is one improper placement, especially where fertilizer is applied too closely to the stems of young Christmas trees.

But this past season we were momentarily baffled by the presence of browned shoots on a white pine hedge in Lewiston. The owner's dog patrolled the area frequently, but the symptoms did not fit a dog urine or mechanical damage scenario. Only after repeated questioning and the process of elimination did we finally diagnose the problem. The homeowner had applied chemical fertilizer with a hose-end applicator which dissolved fertilizer in a jet of water passing through a container to which fertilizer salt had been added.

While popular with homeowners, such contraptions do a poor job of accurately diluting fertilizer concentrates. Exacerbating the problem, fertilizers had been applied to foliage during a period of growth expansion, when new shoots are particularly susceptible to fertilizer salt injury.

Fir-Fern Rust (caused by *Uredinopsis mirabilis*) - Interestingly, we had only one report of this disease last season (from Lewiston). We did note it elsewhere, but only at trace levels. Dry weather during mid to late May may have provided conditions unfavorable to infection over much of the state. We received no reports of **fir-fireweed rust**.

Hail Injury - A severe hailstorm in North Waterford and Albany TWP in August of 1996 caused damage which was still very conspicuous in 1997. Occurring on or about August 30, the storm delivered wind blown hail sufficient to dent vehicles and siding on homes, topple trees, and severely scar branches and twigs of all forest species.

Especially noticeable during the late spring of 1997 was damage to white pine trees which, after losing water all winter through branch wounds and broken twigs, were flagging conspicuously brown. An area perhaps a mile long extending across the Albany/North Waterford town line was especially hard hit, and

even the hardwoods there were still struggling to push limited, clumpy green growth amid mostly bare crowns as late as July of 1997.

The most heavily affected area was just south of the junction of Routes 5 and 35 in Albany TWP and provoked many inquiries of us for an explanation.

Hardwood Decline (caused by multiple stressors) - Extremely wet conditions in 1996 contributed to a general improvement in crown condition of many hardwood species including white ash, sugar maple, yellow, and white birch and red oak in 1997. Even American beech, that had shown a continuing decline for several years, improved in 1997. The deterioration of beech crown condition in recent years has been attributed to several factors including beech bark disease, a recently ended outbreak of variable oakleaf caterpillar, and a mild resurgence of oystershell scale. Probably the most significant recent stressor in beech stands was severe drought conditions in 1995. Dry conditions in 1995 caused premature leaf drop, significantly increased branch dieback, and a general decline in crown health as measured with National Forest Health Monitoring variables.

NFHM variables used to assess crown condition were crown density, crown dieback, and crown transparency. It should be noted that increases in density represent improved crown condition whereas increases in dieback and transparency indicate declining crown condition.

Data from NFHM detection monitoring plots and from a system of 17 National Forest Health Monitoring "special" beech plots were used to assess the status of beech and associated species. Twelve of the special beech plots were established in Maine beech stands in 1995 and have been measured annually. Five additional beech plots were located and measured for the first time in 1997. The condition of beech in Maine as measured by NFHM variables in both plot sets had shown a steady decline for several seasons prior to 1997; however, the 1997 assessments revealed a significant improvement. On the special Maine beech plots (Table 25), mean crown dieback decreased significantly from 15.2 percent in 1996 to 10.9 percent in 1997. This 4 percent decrease in dieback in 1997 followed a nearly 3 percent increase that had occurred between 1995 and 1996. The 1995 and 1996 mean dieback levels for Maine special beech plots were much higher than the NFHM six year (1990 to 1995) detection monitoring plot average for beech in Maine (9.8 percent). However, the 1997 dieback level of 10.9 for special beech plots was not significantly different from the NFHM detection plot six year average.

Beech in NFHM detection monitoring plots system experienced the same trend in crown dieback between 1995 and 1997 as did the special assessment plots (Table 26). Beech dieback levels in each year were lower than in special plots but levels increased significantly between 1995 and 1996 and declined significantly between 1996 and 1997. Associated species (sugar maple, white ash, and yellow birch) in detection plots did not have the same dieback trend as beech during the period. Dieback on these species was highest during 1995 and decreased in 1996 and again in 1997.

Mean transparency and density did not change significantly on special beech plots from 1995 to 1996 or 1996 to 1997 (Table 26). Some small but significant annual changes in crown transparency were detected on some species in the detection monitoring plot set during the period. Crown density did not change significantly from season to season on the detection monitoring plots.

Data for five new special beech plots established in 1997 are included in Table 25 but these data were not included in trend analysis.

Table 25. Maine special beech plots - mean density, dieback, and transparency and annual trends for American beech -1995, 1996, 1997

PLOT	DENSITY			DIEBACK			TRANSPARENCY		
	1995	1996	1997	1995	1996	1997	1995	1996	1997
BIG SQUAW (1)	39.0	42.8	42.8	9.5	12.5	6.5	13.0	14.8	14.8
BIG SQUAW (2)	44.7	46.3	48.1	7.3	12.4	10.1	13.1	13.7	15.3
T3 R12	36.9	40.6	45.9	13.1	23.4	10.1	14.2	20.6	16.9
OTIS	43.5	48.3	48.5	5.2	7.0	6.1	16.3	15.2	15.7
OSBORN	31.8	35.9	35.3	17.3	22.1	15.1	18.9	17.8	18.2
ISLAND FALLS	38.1	36.7	35.6	15.5	18.3	27.5	15.5	15.4	16.2
T15 R6	42.1	40.8	41.9	12.7	13.3	9.2	13.3	15.8	14.8
MORO PLT.	34.8	36.1	38.5	14.8	16.1	9.1	16.0	15.5	14.8
MT. CHASE	44.1	43.2	43.6	16.3	20.0	8.1	13.6	14.5	14.3
SWEDEN	48.1	43.7	46.3	8.1	8.3	7.1	11.0	11.9	12.7
BATCHELDER	41.8	38.3	38.4	18.5	18.5	15.3	18.8	20.5	18.2
PORTER	45.4	43.4	47.1	9.8	10.2	6.5	12.2	15.8	11.1
ALL PLOTS	**40.9**	**41.3**	**42.7**	**12.3**	***15.2**	***10.9**	**14.7**	**16**	**15.3**
1997 NEW PLOTS									
WOODSTOCK			41.8			5.9			12.9
DUCK LAKE (1)			41.8			6.4			13.4
DUCK LAKE (2)			40.6			24.1			17.6
T5 R9			37.3			11.3			15.5
KINGSBURY			42.7			5.7			12.5

* indicates a significant change (p = .05) from the previous year.

Table 26. NFHM detection monitoring plots - mean density, dieback, and transparency and annual trends for northern hardwood type forest species 1995, 1996, 1997

SPECIES	DENSITY			DIEBACK			TRANSPARENCY		
	1995	1996	1997	1995	1996	1997	1995	1996	1997
AMERICAN BEECH	46.1	43.8	49.9	8.7	*11.1	*7.7	14.0	*15.7	15.1
WHITE ASH	44.5	45.2	45.8	11.2	*9.3	*5.8	19.0	18.7	*16.4
YELLOW BIRCH	50.9	55.2	55.3	6.8	*5.2	*4.0	11.8	*10.6	*12.2
SUGAR MAPLE	50.9	52.0	53.3	5.7	*4.8	*3.8	12.0	*13.2	*11.9
HEMLOCK	51.1	47.5	47.3	3.9	*4.8	*5.4	13.6	*16.4	*15.6

* indicates a significant change (p = .05) from the previous year.

Horse-chestnut Leaf Blotch (caused by *Guignardia aesculi*) - This disease seems to occur every year wherever horse-chestnut grows in Maine. In 1997, the expression of disease symptoms was conspicuous, but not extreme. Damage, although aesthetically objectionable, is not considered serious.

Lichens -Lichens growing on dead and dying conifers are frequently and falsely accused of having a role in tree decline and death. We had several reports in 1997 from landowners concerned about lichens. Lichens certainly look as though they ought to be parasitic and many people have a hard time believing that they are not. While they do grow profusely on declining and dead trees, those trees are almost certainly dying for other reasons.

Lichens are comprised of fungi and algae growing symbiotically. Since the algal component is a green plant, light is required for growth. Lichens grow more rapidly when exposed to full light, which explains their profusion on dead trees.

Oak Wilt (caused by *Ceratocystis fagacearum*) - To date there is no evidence that this disease occurs in Maine.

Phomopsis Galls (caused by *Phomopsis* sp.) - Every year we receive a few calls regarding the presence of galls on various species of hardwoods, especially red and black oak. These galls are often very conspicuous, ranging from the size of a pea on smaller twigs to the size of a basketball on larger branches, and are especially evident when leaves are off trees. Typically only one or two trees will be affected in the landscape, with neighboring trees apparently not susceptible. Frequently galls will cause dieback of smaller branches, but generally trees seem to tolerate infection fairly well.

This is a difficult disease to diagnose with certainty because no fungal fruiting bodies are apparent on the galls. The fungus must be cultured from infected tissue and allowed to fruit before a positive diagnosis can be made.

Little is known about the etiology of this disease and it is therefore difficult to recommend effective control actions. However we suggest that in forest stands affected trees be harvested early or as encountered to reduce inoculum. In landscape settings affected trees should be diagnosed early so that attempts may be made to prune infected tissue from trees before the disease gets out of hand.

Pine-Pine Gall Rust (caused by *Endocronartrium harknessii*) - This disease occurs in natural stands as well as in forest and Christmas tree plantations in Maine. We have found it in natural stands of jack pine in such diverse locales as Parlin Pond and Steuben, and in plantations of Scotch and jack pine from all over the state. It occurs especially frequently in Scotch pine plantations, even where no nearby infection is present in the wild, as the result of the planting of infected nursery stock.

Once established in a plantation this disease may be hard to manage. Removal of infected trees (or branches containing galls) early in the rotation and before the end of April each year will help keep the disease from spreading to healthy trees. It is important when establishing plantations of hard pines to plant only healthy nursery stock.

We had only one call regarding this disease in 1997. That was from Gorham, where the disease was a concern in landscape plant material.

Pinewood Nematode (*Bursaphelenchus xylophilus*) - Pinewood nematode in Maine is primarily a problem of stressed trees, especially those stressed by being planted off site. But many plantations (including ornamental plantings) are in fact established off site and we suspect that pinewood nematode has played a role in the mortality of pine and perhaps other species in such situations, even though the presence of pinewood nematode was never confirmed. The pinewood nematode, which causes the most serious disease of pines in Japan (pine wilt), also occurs in the United States in all states east of the Mississippi River. Although pinewood nematode was not discovered in the United States until 1929, it is considered to be a native, not introduced, pest. There is no indication that pinewood nematode has ever caused large scale mortality of conifers in Maine or elsewhere in North America.

Porcupine Damage (caused by *Erethizon dorsatum*) - Reports of porcupine damage to forest trees, evergreen plantations, and ornamental plantings continue at high levels statewide. It is uncertain whether porcupine populations have actually increased in recent years or whether the more numerous reports simply reflect an increasing acreage of higher value conifer plantation and seed orchard trees, situations where porcupine damage is less easily ignored.

In an attempt to define whether porcupine populations are indeed on the rise throughout Maine, one of our staff members has undertaken a count of porcupines killed by vehicles along roadsides in the course of his travels. This survey, known as SPLAT (Special Porcupine Lethal Automobile Tire survey), does not pretend to be scientific, but it may over time provide a rough approximation of porcupine population trends. The staff member undertaking the count consistently drives about 50,000 miles per year and covers the entire state, although the survey is weighted to the Central Maine area where relatively greater travel occurs.

The SPLAT survey is now only three years old and no trends are yet apparent. In 1995, 99 dead porcupines were counted, in 1996 the total was 93, and in 1997 the total was 123.

Rhabdocline and Swiss Needlecasts of Douglas Fir (caused by *Rhabdocline pseudotsugae* and *Phaeocryptopus gaeumannii*) - In recent years we have experienced a gradual reduction in calls related to these two diseases as growers of Christmas trees have cut back or curtailed production of Douglas fir. But a few plantations persist, and where they are established on new sites where Douglas fir was not previously planted, transplants typically grow to almost Christmas tree size before disease becomes epiphytotic.

Many Maine Christmas tree growers lost interest in Douglas fir some time ago because of its extreme susceptibility to *Rhabdocline* and Swiss needle cast fungi under Maine conditions. And in the landscape not only is Douglas fir frequently attacked by these two disease fungi, but it also serves as a powerful alternate host for the buildup of Cooley spruce gall adelgid on Colorado blue spruce when it is planted nearby. So its liabilities often exceed its assets, though it does make a handsome Christmas tree when disease and adelgids are under control.

Rhabdocline and Swiss needle casts appear similar to the casual eye, and while they have slightly different life cycles, the same spray program if broadly applied will control both diseases. For more information on diagnosis and control of these and other Christmas tree pest problems, you may wish to request our Circular No. 11, Integrated Crop Management Schedule for the Production of Christmas trees.

Root Rot of Fraser Fir (caused by unknown fungus (fungi) attacking trees planted off site) - We received more calls than usual in 1997 regarding fraser fir doing poorly in wet areas. Typically, affected trees are at first characterized by slow growth and yellowish foliage, then exhibit mortality in subsequent years.

Most established fir growers are aware that fraser fir must be planted on well-drained sites. However some sites which have produced satisfactory fraser fir crops in the past are this spring supporting fraser fir with extensive root rot symptoms. Heavy precipitation in 1996 may be responsible for converting marginal fraser fir sites to unsuitably wet sites. But pathogen buildup may also be a factor. Fir growers with marginally wet sites are advised to consider balsam or Canaan fir as alternatives to planting fraser fir.

Salt Damage (caused by movement of deicing salts from road surfaces to susceptible plant species) - Salt damage to roadside vegetation in southern Maine was considerably reduced during the 1996-1997 winter season as compared to most other recent years, and was much less extensive than the previous winter (1995-1996) when symptoms were so extreme that many observers had trouble believing that road salt was the only cause. Many were convinced that reformulated gasoline (or its combustion by-products) was responsible, even though reformulated gasoline (RFG) had been introduced to Maine the winter before that (1994-1995), a season characterized by minimal roadside browning symptoms. We trust that this past winter's relatively minor salt damage symptoms in southern Maine will put the RFG issue to rest, at least so far as injury to roadside vegetation (especially white pines) is concerned.

In northern Maine, salt damage levels to roadside vegetation last spring was more pronounced than in southern Maine but similar to previous year levels. Northern Maine experienced considerable snowfall during the 1996-1997 winter season, and apparently did not enjoy the relative reprieve from roadside salt application enjoyed by more southerly areas.

Scleroderris Canker (caused by *Ascocalyx abietina*) - No new infestations of this disease were located during 1997. This disease remains static at very low levels.

Semimature Tissue Needle Blight (SNB) of White Pine (cause uncertain) - Symptoms of SNB on white pines were quite pronounced last season in southwestern and coastal sections of Maine, with scattered trees exhibiting symptoms northward into central Penobscot County. In the most severely affected areas, up to 20% of trees were symptomatic. Affected trees exhibited needle tipburn, with some or all needles in fascicles displaying tissue necrosis of distal portions of needles. Symptoms are typical of what was commonly attributed to sulfur dioxide or ozone injury in the 1960's and 1970's.

More recent research on this problem has indicated that infection by certain needlecast fungi may explain symptoms of SNB on pine in many cases, but no consensus has been achieved among scientists studying this problem. Air pollution symptoms in the northeastern United States including Maine do not seem more severe than usual this year, and ozone monitoring by Maine's Department of Environmental Protection has not elucidated unusually high concentrations of ozone. Sulfur dioxide concentrations remain quite low in comparison to levels of earlier decades.

While we can't be sure what has triggered last season's outbreak of SNB, no long term damage to trees is expected.

Septoria Leaf Spot of Poplar (caused by *Mycosphaerella populorum* syn. *Septoria mussiva*) - The outbreak of this disease which caused poplar leaves statewide to become spotted and brown in July of 1996 subsided in 1997. While the disease was still present at lower levels, it generated no particular public concern.

Sirococcus Blight of Red Pine (caused by *Sirococcus conigenus*) - Sirococcus blight of red pine seems to have increased in severity in Maine in recent years, especially in the Eustis-Flagstaff area, but also in plantations elsewhere in the state. Inquiries to us about this disease in managed forest areas generally fit into one of three categories: (1) infection of reproduction in thinned stands beneath infected overstory vegetation (2) infection of plantations established adjacent to infested natural stands or (3) infection within new plantations which were established in locations remote from known inoculum sources, due to the use of infested planting stock.

In many areas of Maine, serious infection of red pine reproduction beneath infected overstory trees is so probable that it is not cost effective to thin stands to allow for natural red pine regeneration. However white pine seems resistant and may perform well as an alternative regeneration species in such situations.

Infection of plantations established adjacent to infested natural stands is also highly likely, especially if tall overstory trees are left standing. Sirococcus often moves quickly into new plantations established under such circumstances, and by the time the disease is detected, it is often too late for sanitation pruning to be cost effective.

Infection of new plantations due to the use of infested planting stock is also a problem, since the disease is seed borne and seedlings are likely to be infected in nursery beds or greenhouses where container stock is produced. Use of disease free stock is paramount when establishing red pine plantations.

Site Disturbance - Many calls were received in 1997 involving trees which had been stressed or killed as the result of various types of site disturbance. Sometimes the causes were of recent origin, such as sudden changes in drainage patterns; in other instances the causes were chronic and cumulative, such as soil compaction due to years of repeated foot and vehicle traffic. Most common last year were calls regarding problems caused by fill over tree roots. We received such calls from Augusta, Vassalboro, Sanford, Phippsburg, Jefferson, Minot, Lewiston and York, among other locales.

Sphaeropsis Blight (caused by *Sphaeropsis sapinea* syn. *Diplodia pinea*) - This disease, primarily of two-and three-needle pines, seems to have increased in severity in recent years, especially on red pine in mid-coastal areas. Plantation pines seem especially hard hit with symptoms ranging from tip blight to the death of entire trees.

Other than in older red pine plantations in coastal areas, this disease is mostly a problem in landscape plantings around homes and estates, parks, along roadsides and on golf courses. It is generally not a problem in the natural forest environment.

Spring Frost - We have received few reports of serious frost injury to gardens or forest plantations during the spring of 1997. Bud abortion of balsam and Fraser fir Christmas trees (caused by cold temperature injury prior to bud break) was also minimal.

Verticillium Wilt (caused by *Verticillium dahliae*) - This is primarily a disease of maples in ornamental situations but it affects other hardwood species in the landscape as well. Leaves yellow and wilt on branches of affected trees. The disease often progresses until wilt affects the entire crown. Greenish streaks or bands appear in sapwood beneath the bark. The green stain may appear as a partial or complete "ring" in the sapwood when a cut branch is viewed in cross section.

Affected trees may die or recover. Water and fertilizer may stimulate the growth of affected trees and improve prospects for recovery.

The causal fungus is soil borne, so replacing one tree which has succumbed to this disease with another susceptible species on the same site is a very risky proposition. Among trees known to be resistant to *Verticillium* include all the gymnosperms, plus apple and crabapple, mountain ash, beech, birch, butternut, oak, poplar and willow.

Although this disease is not uncommon in Maine, we recorded no inquiries regarding it during 1997.

White Pine Blister Rust (caused by *Cronartium ribicola*) - We continue limited control efforts to manage this disease in certain high value pine stands each year. In 1997 a total of 2,074 acres of high quality pine timber were scouted for *Ribes* plants in Androscoggin, Cumberland, Sagadahoc and York counties. A total of 12,765 *Ribes* were destroyed. Scouting was conducted in the towns of Durham, Eliot, Parsonsfield, Standish, Topsham and Woolwich. Work is presently scheduled for 1998 in Auburn, Dayton, Fryeburg, Gorham, Lisbon, Lyman and Wells.

Triclopyr (Garlon 4) remains our herbicide of choice, mixed at the rate of 6 oz./gallon of water. In 1997 a total of 151.5 ounces of Garlon 4 was mixed with water to provide a total finished volume of 25.25 gallons.

White pine blister rust continues to be a problem of trees in the landscape as well, often involving trees which were infected when purchased as nursery stock.

This disease remains static at moderate levels.

Winter Injury - The winter of 1996-1997 was relatively mild, especially in central and southern portions of Maine, and most plant species exhibited little or no winter injury. Even the relatively tender dwarf Alberta spruce generally exhibited only minor foliage browning symptoms. And while southern Maine experienced some fairly brisk winds during the winter, wind damage was much reduced over the previous winter season (1995-1996).

Northern Maine experienced a few damaging wind events in December and February which took down conifers in certain selectively harvested areas. But despite heavy snowfall, snow damage was minimal.

Higher elevation red spruce browning was relatively minor last spring, possibly due to the fact that winter temperatures never rose high enough for sufficient durations for this species to lose its natural winter hardiness.

Yellow Witches'-Broom of Balsam Fir (caused by *Melampsorella caryophyllacearum*) - Several Christmas tree growers noticed an "explosion" in the occurrence of small yellow "witches'-brooms" among the foliage of their balsam fir trees last spring. Many of these small brooms emerged from portions of branches which represented 1995 growth, indicating a favorable infection period occurred in the spring of that year. But only last year did brooms become conspicuous. In 1995 only slight, elongate swellings would have been apparent to the careful observer. And in 1996 only small stunted shoots were apparent as the result of 1995 infection. But in 1997 the brooms attained the size of a fist, and finally became conspicuous to the more casual observer.

Last June we recommended that Christmas tree growers begin to remove these growths as they encountered them, and any growers who did not do so should delay no longer since the larger these perennial growths become, the larger "hole" they will leave when galls are finally pruned from the trees.

Forestry Related Quarantines in Maine

There are four forestry related quarantines which are in effect in Maine. They are: White Pine Blister Rust, Gypsy Moth, European Larch Canker, and Hemlock Woolly Adelgid.

I. The White Pine Blister Rust Regulations and Quarantine are listed under Title 12 MRSA 1988, Subchapter III, §803:8305 Shipment Prohibited.

The director may prohibit, prevent or regulate the entry into or movement within the State, from any part thereof to any other part, of any plants of the genus *Ribes* or other nursery or wildling plants, stock or parts of plants which may cause the introduction or spread of a dangerous forest insect or disease. The director may issue the necessary orders, permits and notices necessary to carry out this section which shall not be considered to require or constitute an adjudicatory proceeding under the Maine Administrative Procedure Act, Title 5, Chapter 375.

Regulation: White Pine Blister Rust, Quarantine on Currants and Gooseberry Bushes.

A. The sale, transportation, further planting or possession of plants of the genus *Ribes* (commonly) known as currant and gooseberry plants, including cultivated wild, or ornamental sorts) is prohibited in the following Counties in the State of Maine, to wit: York, Cumberland, Androscoggin, Kennebec, Sagadahoc, Lincoln, Knox, Waldo, Hancock, and parts of Oxford, Franklin, Somerset, Piscataquis, Penobscot, Aroostook, and Washington.

B. The planting or possession of European Black Currant, *Ribes nigrum* or its varieties or hybrids anywhere within the boundaries of the State of Maine is prohibited. This quarantine is administered by the Insect & Disease Management Division of the Maine Forest Service, phone 287-2431 or 287-2791.

II. The Gypsy Moth Quarantine is listed under 7 CFR Part 301.45, United States Department of Agriculture, Animal & Plant Health Inspection Service, Plant Protection and Quarantine as printed in the Federal Register.

A. This quarantine designates the infested area in Maine as quarantined for the movement of regulated articles, which includes wood such as logs, pulpwood, trees, shrubs, firewood,Christmas trees, and chips, and requires the inspection and certification of such material if movement is to non-infested states and foreign countries. This is administered by the USDA-APHIS, PPQ in Bangor, Maine, phone 945-0479.

B. Inasmuch as Maine is not completely infested and quarantined, wood or regulated articles moving from the infested area of the state to the non-infested area must be accompanied by a certificate or go to a mill under state compliance agreement which allows the reception of such articles. Regulated articles moving from the non-infested area of the state to other non-infested states or non-infested parts of Canada must be accompanied by a state permit stating that the regulated article originated outside of the infested area of the state. This is managed by the Insect & Disease Management Division of the Maine Forest Service, phone 287-2431 or 287-2791.

III. The European Larch Canker Quarantine is listed under 7 CFR Part 301.91 of the United States Department of Agriculture, Animal & Plant Health Inspection Service, as published in the Federal Register, and also under Title 12 MRSA, §8305 of the Laws of the State of Maine.

A. This quarantines all parts of larch (*Larix* spp.) including logs, pulpwood, branches, twigs, etc., as regulated articles.

B. Also any other product, article, or means of conveyance whatsoever, when it has been determined by an inspector that it presents a risk of spread of the disease.

C. Designates parts of Hancock, Knox, Lincoln, Waldo, and Washington Counties as the quarantined area from which movement is restricted.

This is managed by the USDA-APHIS, PPQ in Bangor, Maine, phone 945-0479, and the Insect and Disease Management Division of the Maine Forest Service, phone 287-2431 or 287-2791.

IV. The Hemlock Woolly Adelgid Quarantine is listed under 7 MRSA, Chapter 409, §2301-2303 of the Laws of the State of Maine.

This quarantine was adopted to attempt to prevent the introduction of the Hemlock Woolly Adelgid (*Adelges tsuga* Annand) into Maine. This pest has been found to cause mortality of Eastern Hemlock (*Tsuga canadensis*) in infested states. Since hemlock is a major component of Maine's forest on over one million acres, protection of this valuable resource from damage by the Hemlock Woolly Adelgid is essential.

A quarantine is established against the following pest and possible carriers.

A. Pest: Hemlock Woolly Adelgid (*Adelges tsugae* Annand).

B. Area Under Quarantine: The States of Connecticut, Delaware, Maryland, Massachusetts, New Jersey, New York, Pennsylvania, Rhode Island, Virginia, Alaska, California, Oregon, Washington, and the District of Columbia.

C. Articles and Commodities Covered: Hemlock seedlings and nursery stock, logs, lumber with bark, and chips.

D. Restrictions: All articles and commodities covered are prohibited entry into the state from the area under quarantine unless specified conditions (listed below) are met.

1. Hemlock seedlings and nursery stock are: admissible into Maine provided each lot is accompanied by a certificate issued by the Department of Agriculture or Conservation of the State of the origin with an additional declaration that said material is free from Hemlock Woolly Adelgid.

2. Hemlock logs, lumber with bark, and chips are: admissible provided that said material is only shipped to preapproved sites within Maine. Such shipments must be made under a compliance agreement between the shipper and the Maine Forest Service, Department of Conservation. If said material is shipped to other sites, it must be accompanied by a certificate issued by the Department of Agriculture or Conservation of the state of origin affirming (a) the material was grown in the state of origin, and that either (b) the material is free from Hemlock Woolly Adelgid, or that (c) the material originated from an uninfested area in the state of origin.

This quarantine is administered by the Maine Department of Agriculture, phone 287-3891 and the Insect and Disease Management Division of the Maine Forest Service, phone 287-2431 or 287-2791.

Additional information is available in the free fold-out leaflet:

Ouellette, D.E. (Compiler). 1997 (April). Regulations and Guidelines for Shipping Christmas Trees, Wreaths and Decorative Plant Materials - Twigs, Nuts & Fruits Used in Wreath Making. A public information guide from the Plant Industry Div., Me. Dept. of Agr. and the MFS, I&DM Division. A pocket fold-out.

Maine Forest Service
DEPARTMENT OF CONSERVATION
INSECT & DISEASE MANAGEMENT DIVISION PUBLICATIONS
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23. Trial, Jr., H. and M.E. Devine. Spruce Budworm in Maine: Results of the 1984 Project, Biological Conditions in 1984, and Expected Infestation Conditions for 1985. April, 1985. 75 pp.

24. Trial, Jr., H. and M.E. Devine. Spruce Budworm in Maine, Results of the 1985 Project, Biological Conditions in 1985 and Expected Infestation Conditions for 1986. August, 1986. 71 pp.

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26. Trial, Jr., H. and J.B. Dimond. An Aerial Field Trial Evaluating Split Applications and New Formulations of *Bacillus thuriengiensis* Against the Spruce Budworm, *Choristoneura fumiferana* in Maine. March, 1988. 20 pp.

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33. Trial, Jr., H. and M.E. Devine. Forest Health Monitoring Evaluation: Brown Ash (*Fraxinus nigra*) in Maine - A Survey of Occurrence and Health. May 1994. 37 pp.

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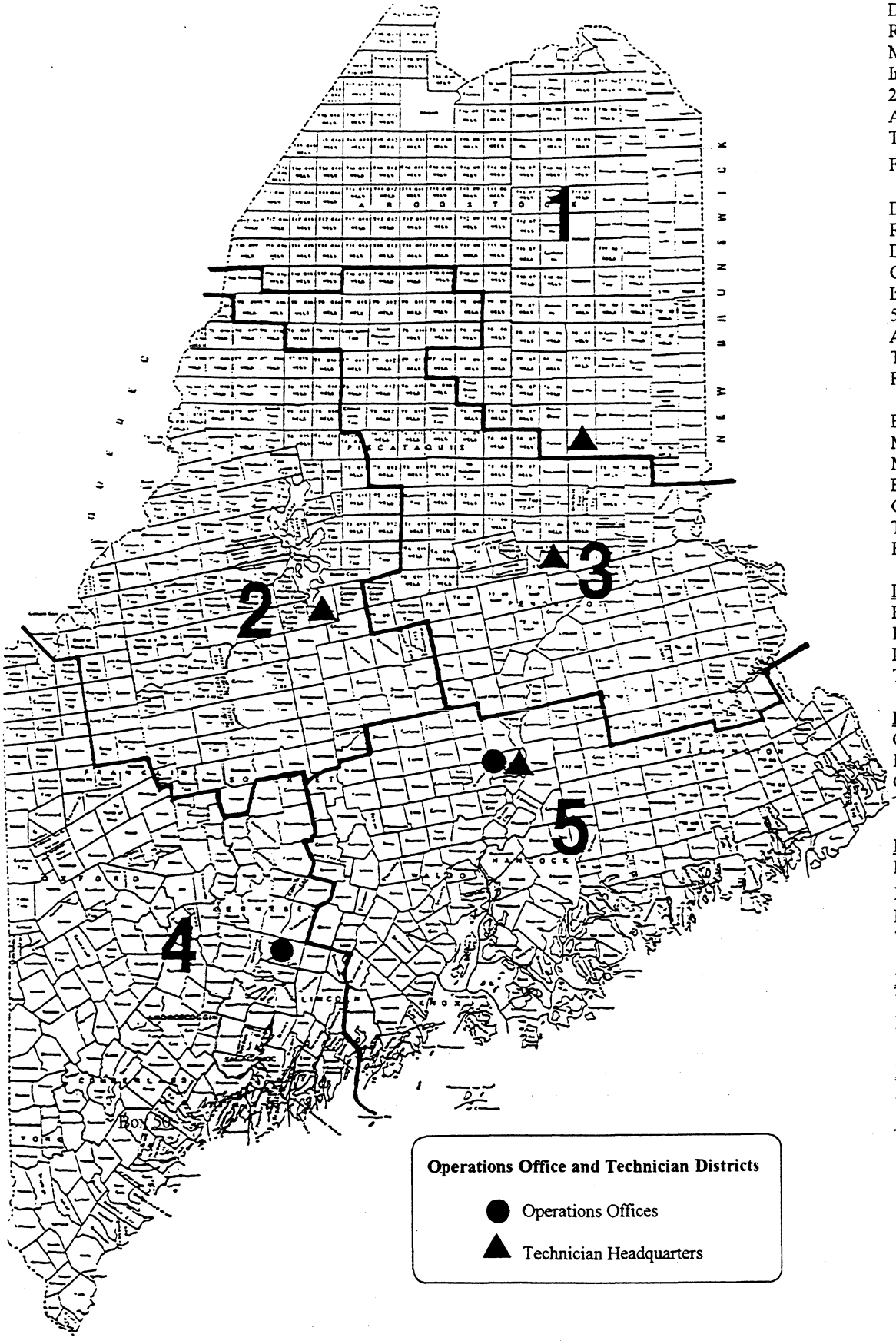

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